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The National Guard

ARMY ORDNANCE

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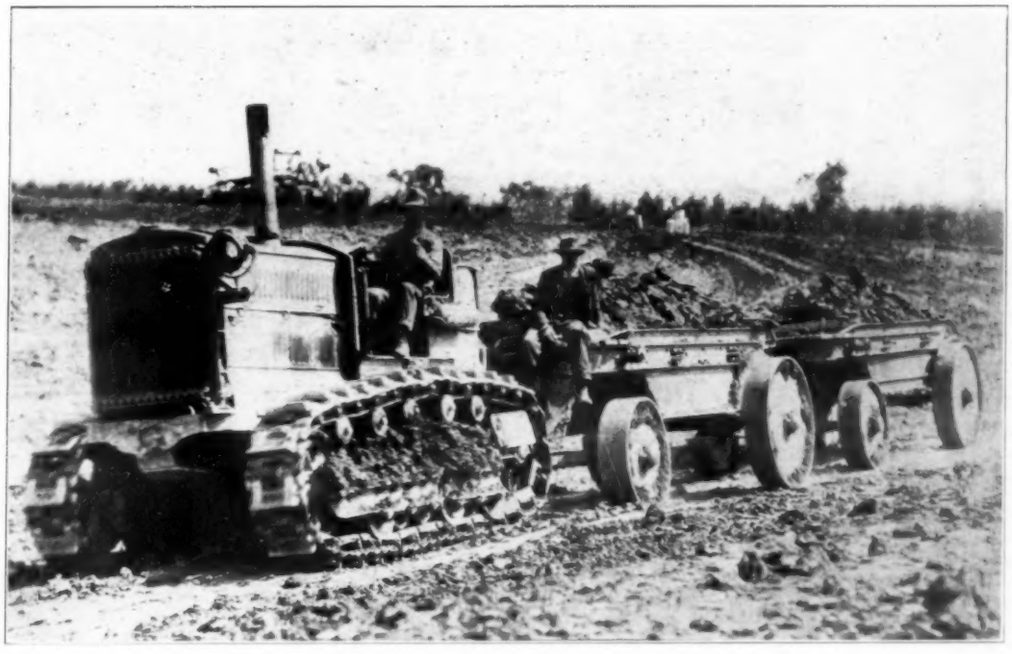

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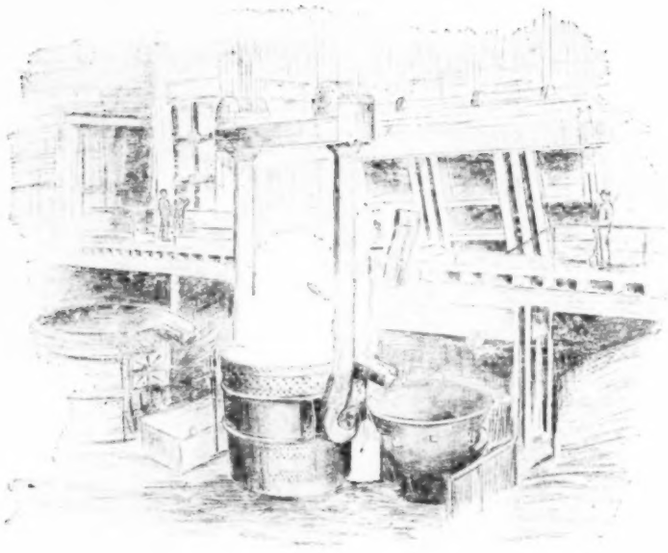

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THE MILITARY MEDAL

of the

Army Ordnance Association

(See Page 728)

Secretary of War Emphasizes Importance of Army Industrial College

EMPHASIZING the need for trained officer personnel in the War Department qualified to cope with all the industrial conditions of modern war, Hon. John W. Weeks, Secretary of War, addressed the graduating class of the Army Industrial College at the graduation exercises held on February 2nd. This was the second class to be graduated by the College which was opened on February 21, 1924, for the purpose of training officers of the Army in the higher functions of procurement and supply. The Secretary congratulated those who had guided the College through the formative periods of its existence, and expressed the hope that its influence and work would gradually broaden both as to the number of students to be trained and the influence to be exerted upon all branches of the service. The Secretary's address follows:

Hon. John W. Weeks

"Gentlemen of the Graduating Class and of the entering Class:

It is a great pleasure for me to avail myself of this somewhat unusual opportunity to address two successive classes at the same time. The occasion is also worthy of remark in another connection. The Army Industrial College has reached a milestone in its career—it has passed its first anniversary. It was one year ago yesterday that the first class entered into the work of the course, although the formal opening had to be postponed until February twenty-first.

It is natural on the occasion of an anniversary to look back, to review what has been accomplished and to endavor to draw lessons from the past which shall be of value as a guide to the future. The College was established to meet what seemed an evident need. We have had for many years the War College which has prepared military men to exercise general staff and higher command functions. Our experiences during the World War speak more eloquently than can words of the manner in which the War College has carried out its mission.

Unfortunately, we never before have had an institution primarily devoted to the study of the industrial aspects of National Defense. The reasons for this are not hard to discover. Prior to the World War no nation had a conception of the primary importance which industry now plays in warfare. No Mahan had arisen to point out "The Influence of Industry upon History." Looking backward, the preparation which had been made to furnish the combatant European troops with munitions and supplies seem pitifully inadequate. The situation in America, as you all know, was even worse.

This failure was not due to lack of thought and study upon the part of competent officials. Many brilliant men (notably in France and in Germany where problems had an especial significance to the respective governments) had devoted their lives to the study of past wars for the purpose of drawing conclusions useful in planning for future emergencies.

The truth is that the world in its social and economic development had passed into a new epoch and this fact was not appreciated until it burst into painful realization during the World War. This is not a surprising matter. The chief educational force of the world is experience. Our peace-time industrial activities are carried on continuously. There is devoted to their prosecution a large proportion of our national intelligence. Yet the economic and industrial effects of such great inventions as the steam engine, the power loom, the cotton gin, the automobile, and so forth, have always emerged slowly and as developed by experience. It would be captious to criticize the military authorities of the nations for not exercising a greater power of prevision than the industrial leaders.

To meet the industrial situations thrust upon them during the World War, the warring powers were forced to adopt administrative measures of the most drastic character. These were forged out upon the anvils of harsh necessity by the hammer of immediate expediency. Our principal allies found it necessary practically to supersede the previously existing munitions supply agencies by new bodies entirely under civilian control. In the United States our War Department supply branches survived, but the War Industries Board finally emerged as a coordinating agency over them. It laid an iron grip upon American industry and with the help of other super-agencies, such as the War Trade Board, the Shipping Board, the Fuel Administration, the Food Administration, the Railroad Administration and others, a fair semblance of order was ultimately brought out of chaos.

The super-agencies were typically American in genesis and in spirit. They performed their work in a marvelously effective manner. The lessons which we learn from a study of their operations must ever be our guide in planning for a future emergency. But it would be a fatal thing to let matters rest as they are, going on as we did before the war with our military preparedness program but leaving the corresponding industrial program await the event. Congress, realizing this, created the office of the Assistant Secretary of War in 1920, with statutory duties. After four years' effort on the part of this office, it became apparent that the prosecution of the task would be very materially expedited if a group of officers could be relieved of all current work and given the opportunity to devote their entire time to the study of the question of industrial preparedness in its broadest aspects and from all angles. It was for this reason that the Army Industrial College was created.

I feel that the College has already demonstrated its value for the purposes intended. A very appreciable dividend has been paid upon its work to date. I am sure that its place in our military system will become of increasing importance as those who assisted in carrying the torch during the World War pass, one by one, from the scene and are gradually replaced by men whose knowledge of war conditions must come from study and deliberation rather than from actual experience.

I regret that the present necessity for trained personnel requires that, at the present time, the course be limited to five months. We hope that it may soon be possible to extend it to a full academic year. We also hope to gradually place the instruction on a basis more nearly resembling that of the War College and of such civilian post-graduate schools as the Harvard School of Business Administration. This is not meant to be a reflection upon the existing course, but like everything else, colleges such as we hope this to become do not "spring full armed from the brain of Jove." They must be created through a process of gradual evolution and our present concern is that the foundation we are laying shall be sound and our progress as rapid as conditions permit.

To those who are about to graduate, I extend my heartiest congratulations. It has been your lot to take the course during its formative stages. You have contributed much of constructive effort which will appear in the structure when it has reached its final form. Unfortunately, on account of the contingencies of the service, it appears to have been impracticable to assign all of you at the present time to work which would permit you to apply, immediately, the lessons you have learned and the conclusions you have drawn. I am sure, however, that in your future careers you will feel abundantly repaid for your recent efforts and the Army and our Government will secure that benefit which constitutes the only justification for the existence of this institution. Doubtless it will be but a short period until no important office having to do with the procurement activities of the War Department will be filled except by graduates of this College or officers having had equivalent training.

To those of you who are just entering upon the work of the College, I extend my heartiest wishes for success. Some of you were in Washington during the trying days of the World War and will have a first-hand appreciation of the difficulties which were encountered. All of you will find the work of the College of great interest and I can assure you that it is of the utmost importance to the War Department.

It is an especial pleasure to be able to welcome into the new class representatives of the Navy Department. There has been a marked and most gratifying tendency in our Government of recent years towards a breaking down of the rigid compartments into which its various branches had tended to segregate themselves. After all, we have but one national Government and anything which tends toward unity of purpose and action is good. Close cooperation between the Army and Navy is particularly important at all times. In time of war it is imperative. As Naval Officers you will bring to the College a viewpoint and an experience that will be invaluable in assisting us to develop the course until it shall cover, in an adequate manner, the entire ground pertaining to industrial preparedness. I trust that you will feel that you are full-fledged members of the student body. I assure you that your comments and constructive criticisms will be as welcome and as valuable to us as those of any other members.

In concluding, I wish to again assure you of my heartfelt wishes for the success which I know you will have in the furtherance of this great work for our National Defense."

The following officers, composing the second class, were graduated:

Lieut. Col. Wm. G. Ball, Q. M. C.; Major Lucius L. Hopwood, M. C.; Major H. H. Arnold, A. S.; Major R. R. Nix, Ord.; Major Wm. A. Borden, Ord.; Capt. T. J. Hanley, A. S.; Capt. Vennard Wilson, Ord.; Lieut. Col. Robert Davis, S. C.; Major Clifford L. Corbin, Q. M. C.; Major James W. Lyon, C. W. S.; Major Cherubusco Newton, Finance; Major Edwin G. Kelton, C. E.; Capt. Wilbur S. Elliott, Q. M. C.

The incoming third class of the Industrial College was present at the graduation exercises of the second class, and immediately following the exercises took up their studies. The members of the incoming class are as follows:

Captain J. R. Defrees, U. S. Navy; Lieut. Col. Clement C. Whitcomb, M. C.; Lieut. Col. Richard T. Ellis, Q. M. C.; Lieut. Col. Walter C. Baker, Q. M. C.; Major Alvin G. Gutensohn, S. C.; Major Douglas C. Cordiner, Q. M. C.; Major Ira A. Rader, A. S.; Major Shepler W. Fitzgerald, A. S.; Major Russell L. Maxwell, Ord.; Major James L. Frink, Q. M. C.; Capt. Sylvester E. Nortner, C. E.; First Lieut. Hugh W. Rowan, C. W. S.; Capt. J. J. Cheatham, S. C., U. S. Navy; Commander D. J. Cather, M. C., U. S. Navy; Lieut. Col. Chas. E. Reese, Q. M. C.; Major Larry B. McAfee, M. C.; Major Fred Seydel, C. W. S.; Major C. A. Schimelfenig, Ord.; Major Douglas B. Netherwood, A. S.; Major Rudolph W. Riefkohl, Q. M. C.; Major Harry F. Cameron, C. E.; Capt. E. E. MacMorland, Ord.; Capt. Wm. J. Henry, Ord.; First Lieut. Chas. W. Steinmetz, A. S.

The National Guard

By

MAJ. GEN. GEORGE C. RICKARDS

Chief, Militia Bureau

THE Militia Bureau personnel consists of 30 officers and 84 civilian employees. The Chief is appointed by the President, under the provisions of Section 81, N. D. A., for a period of 4 years from among a list of National Guard officers recommended by the Governors of the various States, and has the rank and pay of a Major General while so serving. Three of his officer assistants are also National Guard officers on an active duty status. The remainder are drawn from among those officers of the Regular Army who have had experience with the National Guard. The Bureau is organized in six sections, namely: Administrative, Personnel, Organization, Training, Finance and Supply, and Planning. These function under the supervision of an Executive Officer who coordinates their work.

General Rickards

At present War Department orders (G. O. 6, 1922) define the duties of the Militia Bureau as "facilitating the administration and promoting the development of the National Guard while not in the service of the United States," and states that "the primary function of the Chief, Militia Bureau, is the development of a high state of efficieney in the National Guard."

Specifically, and with reference to the National Guard, the Militia Bureau is the executive ageney of the War Department for carrying out its policies in the development of the National Guard not in Federal service. The Chief is also the technical advisor of the War Department in all National Guard matters. The Militia Bureau is the proper channel of communication between the War Department and the State authorities, and between the War Department and Corps Area Commanders, in all matters pertaining to the National Guard. It is the War Department office of record for all correspondence relating to National Guard affairs and the unorganized militia, and, as the proper War Department agency, should issue all orders, circulars, and other instructions referring exclusively to the National Guard. It controls the apportionment, allotment and disbursement of all Federal funds appropriated by Congress for the support of the National Guard, and extends to individuals and organizations the Federal recognition which enables them to participate in such appropriations. It is to be noted that the National Guard is not commanded by any Federal authority unless called into Federal service.

Organization and Mission of the National Guard

a. Organization. The National Defense Act provides that the organization of the National Guard shall be that prescribed for the Regular Army, with such general exceptions as may be prescribed by the Secretary of War.

The National Defense Act also provides that no National Guard unit need have a greater enlisted strength for Federal recognition and for the first six months following recognition than 50; that the Secretary of War shall preseribe a maintenance strength for all recognized units, and that officers will not receive pay for any armory drill unless 60 per cent of the maintenance enlisted strength attend.

Because of the provisions of law just mentioned; because it is more difficult for the National Guard to expand into additional units in an emergeney than for the Regular Army to do so; and because it is desirable in rare cases to permit a company or similar unit to organize in two stations instead of at a single one, it has become necessary to make general exceptions to the organization prescribed for the Regular Army. These exceptions are expressed in Tables of Organization. New tables now in process of preparation in the Militia Bureau will contain for each unit the maximum peace strength allowed for units and the recognition, maintenance and peace strengths for units when organized at a single station and for the subdivisions when organized at two stations.

The passing from a peace table to a war table of organization for any National Guard unit would require exactly what is required for the corresponding Regular

Army unit. The organization of the National Guard, therefore, while permitting units to be maintained at strengths usually considerably below peace strength, is such that any unit can be called or drafted into the Federal service and serve with other components of the Army without alteration of any part of its organization.

Not all of the units necessary for a balanced force suited to a draft into Federal service in a major operation are organized in a manner that would be best suited for State service. There are many units, such as trains, balloon companies and G. P. F. regiments of field artillery, required to be raised by the States as parts of a balanced force which are wholly unsuited for the character of service required in the State. When States apply for it they are permitted to arm such units with rifles, in addition to the arms prescribed and in order that the States may be able to get some service from them in local emergencies. No variation in organization is permitted any unit to better fit it for State duty. The organization of the National Guard is designed altogether for Federal service.

b. Mission. The mission of the National Guard is expressed in the new National Guard Regulations, which, however, have not yet been approved by the General Staff, as follows:

"In time of peace, to provide a means by which the citizen may fit himself for military service without leaving his usual vocation, and to provide an adequate and effective force, available in minor emergencies for employment by the States or by the United States; in time of war, to provide an adequate, balanced and effective component of the Army of the United States for employment within the United States or elsewhere. In time of emergency, or of war, the National Guard, in general, forms with the Regular Army the first line increment or component of the Army of the United States. It may, however, in specific war plans be designated in whole or in part as the second line or increment of the Army."

It will be seen that this mission requires the National Guard to be an adequate and efficient State force to cope with local emergencies. This is required because the National Defense Act prohibits the States maintaining any other State force except police or constabulary. The National Guard is placed in the first line increment because the Regular Army alone is not sufficiently strong to perform what is required of this increment.

c. The powers of and limitation upon authority for the employment of the National Guard. In its dual status the National Guard is subject to employment by both State and Federal Government.

The constitutions and laws of the several States set out the conditions under which the National Guard may be used in aid of the civil authority. In all the States the Governor is empowered to call out the National Guard, and in some States a like power has been given to certain subordinate officers. The Governor being invested with authority to call out the National Guard to suppress insurrections, his determination that an insurrection exists and that the intervention of the militia is necessary to quell it is not subject to review by the courts.

The source of the authority of the Federal Government to use the National Guard as a Federal force is Section 8 of Article I of the Federal Constitution. This section which has to do with the powers of Congress, provides that Congress shall have power to declare war; to raise and support armies; to make rules for the Government of the land and naval forces; to provide for calling forth the militia to execute the laws of the Union; suppress insurrections, and repel invasions; to provide for organizing, arming and disciplining the Militia, and for governing such part of them as may be employed in the service of the United States, reserving to the States, respectively, the appointment of the officers, and the authority of training the militia according to the discipline prescribed by Congress. By Section 1 of Article II of the Constitution, the President is commander-in-chief of the militia of the several States when called into the actual service of the United States.

Congress has exercised its power by providing for the entry of the National Guard into Federal service by two methods designated as "call" and "draft." The National Guard, by Section 58, National Defense Act, is a part of the militia and its Federal use as such is governed by several statutes, one of which dates back to 1795, and which provides that the President may call out the militia to repel invasion, suppress insurrection whether against the United States or a State, or execute the laws. The National Guard when serving under a call by the President retains its status as a State force, except that the control over it, aside from the appointment of officers, passes to the Federal Government. The appointment of officers of the militia is, by the Constitution, reserved to the States and the Governors thereof continue to exercise this power when the National Guard is in the actual service of the United States under a call.

Section 5 of the Act of January 21, 1903, as amended by Section 4 of the Act of May 27, 1908, provides:

> "That whenever the President calls forth the organized militia of any State, Territory, or of the District of Columbia, to be employed in the service of the United States, he may specify in his call the period for which such service is required, and the militia so called shall continue to serve during the term so specified, either within or without the territory of the United States, unless sooner relieved by order of the President: Provided, That no commissioned officer or enlisted man of the organized militia shall be held to service beyond the term of his existing commission or enlistment: Provided further, That when the military needs of the Federal Government arising from the necessity to execute the laws of the Union, suppress insurrection, or repel invasion, cannot be met by the regular forces, the organized militia shall be called into the service of the United States in advance of any volunteer force which it may be determined to raise."

However, the Attorney General of the United States, in an opinion dated February 17, 1912, held that—

> "The Constitution, which enumerates the exclusive purposes for which the militia may be called into the service of the United States affords no warrant for the use of the militia by the General Government except to suppress insurrection, repel invasions, or to execute the laws of the Union, and hence the President has no authority to call forth the organized militia of the States and send it into a foreign country with the Regular Army as a part of an army of occupation."

Thus it appears that notwithstanding the provision above referred to from Section 5, Act of January 21, 1903, as amended by Section 4, Act of May 27, 1908, the National Guard could not be sent out of the limits of the United States to execute the laws of the Union, for such laws would apply only within our own country. While I know the following is contrary to legal decisions on this question it is my own opinion that the President has authority to send the National Guard, in Federal service under call, outside the limits of the United States if in

his judgment it should be necessary in the suppression of an insurrection or the repelling of an invasion against our own country or any part of it, and that to conclude otherwise would be to assume an unnecessary restriction upon the powers of the President to safeguard the Union and to guarantee to every State in the Union a republican form of Government.

However, it is to be noted that there is nothing to prevent the National Guard, when called forth on a proper occasion, from being sent outside of their own States in the service of the general Government. It is also to be noted that Section 6 of the Act of January 21, 1903, provides "that when the militia of more than one State is called into the actual service of the United States by the President he may, in his discretion, apportion them among such States or Territories or to the District of Columbia according to representative population."

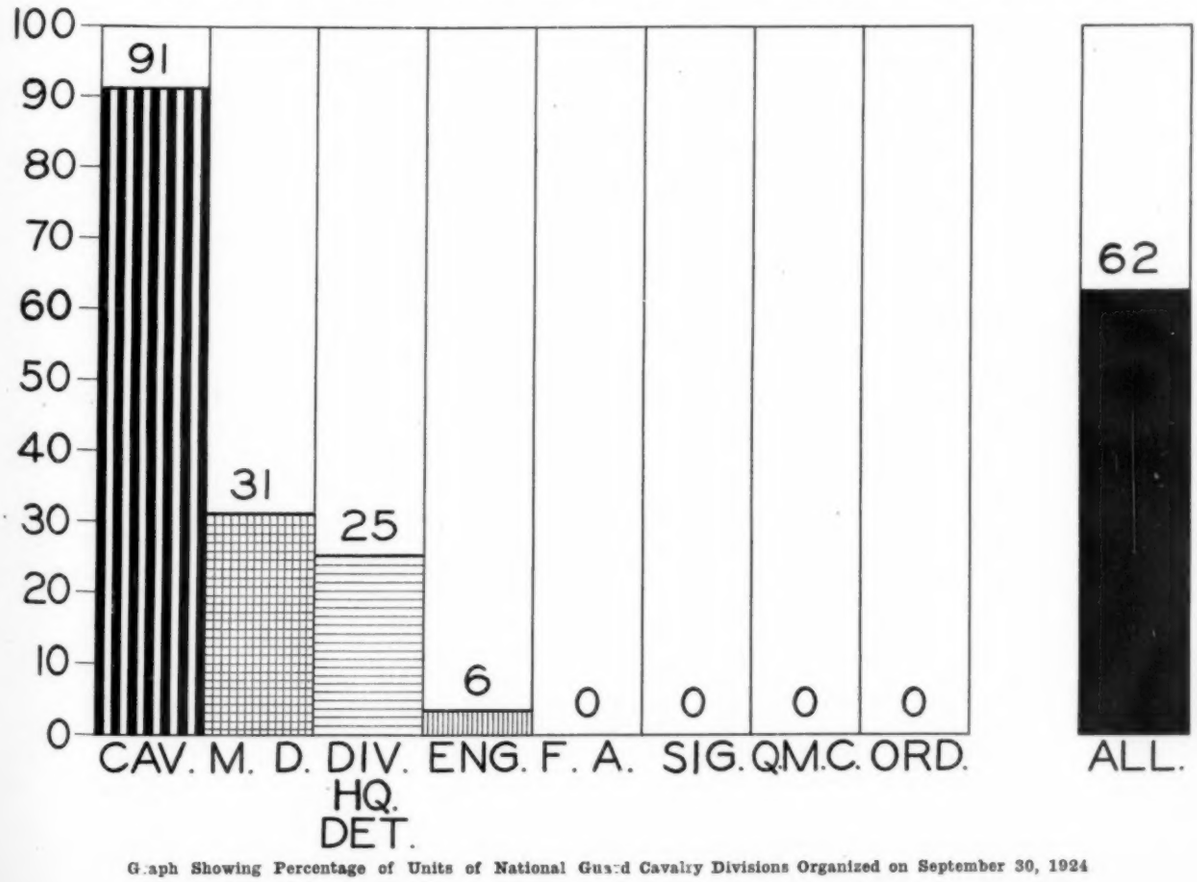
The provisions of law relating to the draft of the National Guard are found in Section III of the National Defense Act, which reads:

"When Congress shall have authorized the use of the armed land forces of the United States for any purpose requiring the use of troops in excess of those of the Regular Army, the President may, under such regulations, including such physical examination, as he may prescribe, draft into the military service of the United States, to serve therein for the period of the war or emergency, unless sooner discharged, any or all members of the National Guard and of the National Guard Reserve. All persons so drafted shall, from the date of their draft, stand discharged from the militia, and shall be subject to such laws and regulations for the government of the Army of the United States as may be applicable to members of the Army, whose permanent retention in the military service is not contemplated by law, and shall be organized into units corresponding as far as practicable to those of the Regular Army or shall be otherwise assigned as the President may direct. The commissioned officers of said organizations shall be appointed from among the members thereof; officers with rank not above that of colonel to be appointed by the President alone, and all other officers to be appointed by the President by and with the advice and consent of the Senate. Officers and enlisted men while in the service of the United States under the terms of this section shall have the same pay and allowances as officers and enlisted men of the Regular Army of the same grades and the same prior service. On the termination of the emergency all persons so drafted shall be discharged from the Army, shall resume their membership in the militia, and, if the State so provides, shall continue to serve in the National Guard until the dates upon which their enlistments entered into prior to their draft, would have expired if uninterrupted."

When drafted the National Guard is a part of the Army of the United States and subject to the same service as may be required of any other component of the Army. Officers of National Guard organizations drafted under the provisions of this section are, under provisions of the National Defense Act, appointed in the Officers' Reserve Corps and commissioned in the Army of the United States.

Relation of the National Guard to the War Department, Corps Area, and Militia Bureau

It must be kept clearly in mind that until called into Federal service the National Guard of each State is a



Graph Showing Percentage of Units of National Guard Cavalry Divisions Organized on September 30, 1924

distinct and separate force, and that the Governor of the State is its supreme commander. No Federal official can exercise any command over such a force unless commissioned in it, and such commission can be issued only by the State concerned. Federal influence over the development of these State forces is based upon two factors: *First,* a patriotic and common sense willingness upon the part of the State to so organize and train its forces that it is ready to contribute its share toward a well-balanced, efficient force at the disposition of the Federal Government in time of emergency; and *second,* that when these State forces comply with certain conditions specified by the Federal Government, the latter lends them their equipment and meets part of the expense of their training. Hence, the States look to the Militia Bureau of the War Department for guidance and assistance in training their forces, and for the military supplies necessary to equip them. In rendering this assistance the Militia Bureau works through the Corps Area Commanders and in some matters delegates final action to them as I will bring out in more detail a little later. The status of both the Militia Bureau and the Corps Areas in their relations with the States is advisory, prescribing the standard to be attained and assisting the States in every possible way to reach that standard. The only remedial action possible to the Federal Government when an organization or individual fails to come up to the standard is the withdrawal of Federal recognition and the consequent loss to the organization or individual concerned of Federal aid. Standards prescribed are, of course, in accordance with approved War Department policies.

Mobilization

The Chief of the Militia Bureau is the technical advisor of the War Department in all matters pertaining to the mobilization of the National Guard; but this is not the only responsiblity in connection with mobilization which falls upon his shoulders. If the National Guard is to mobilize for war or emergency, smoothly and successfully, advance plans must be made, in each State, to meet every foreseen contingency arising from a call or draft of its Guard. In this connection, it is the duty of the Chief of the Militia Bureau to make every practicable effort to have the States prepare such plans and, thereafter, to keep them revised. The plans at present in process of preparation can be classified as follows:

a. Unit mobilization plans for all Federally recognized National Guard organizations.

b. Plans of States for organizing National Guard units, the immediate organization of which has, for various reasons, been deferred to some future time.

c. Plans of States for the organization of purely State forces such as State guards, police, or constabulary, to replace the National Guard called or drafted.

d. Plans for the operation of the office of each State Adjutant General in event of mobilization.

A brief description of the plans indicated in the four above-mentioned categories may be of some slight interest, so I will touch upon the scope of each, in turn:

First, and most important, are the unit mobilization plans for organized units. In the National Guard—the same as in the Regular Army and Organized Reserves—the commander of each Federally recognized unit, down to and including companies and smaller independent detachments, prepares and keeps up to date a unit plan for the mobilization of his unit. The unit mobilization plan, when approved by the next higher commander, is, in effect, the directive for the mobilization of the unit. The chain of preparation, coordination and approval of these plans extends upward, through each higher commander in a State, until it reaches the Corps Area Commander. Much progress has been made during the past year in the preparation of these plans with the result that a large majority of all Federally recognized National Guard units now have their plans completed.

The plans which stand second in order of relative importance, particularly with reference to the War Department's General Mobilization Plan, are the plans of States for the future organization of National Guard units allotted them, the actual organization of which has, for various reasons, been deferred until some future date. These deferred or, more preferably, unorganized National Guard units, may be separated into three classes, viz:

a. Those units which have been deferred, for the time being, on account of inadequate appropriations.

b. Those units which have been allotted to States for organization (under the 250,000 peace-time strength restrictions), at a date not later than June 30, 1926.

c. Those units allotted to States under the original allotment plan (of 800 men per each Senator and Representative in Congress) which are in excess of those called for under the 250,000 peace-strength restriction.

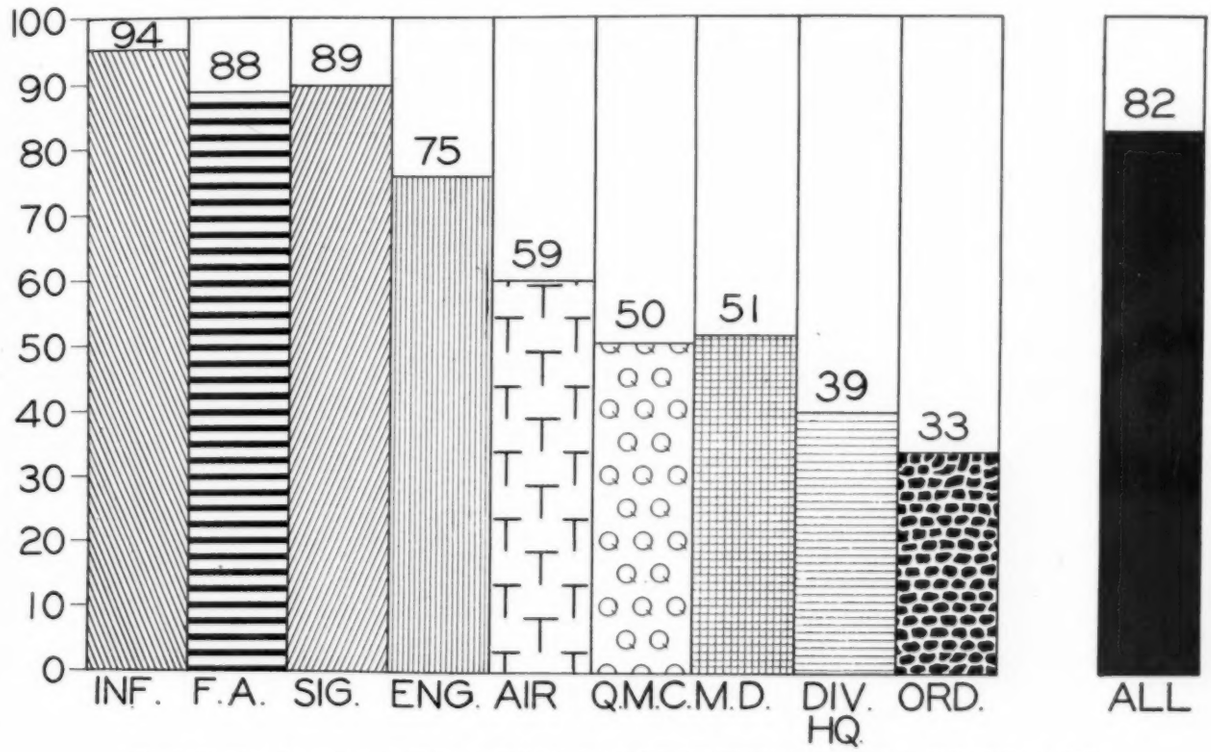
In the case of these latter units, it is very probable that little effort will be made to organize them until an actual mobilization is impending. This is because of the fact that the great majority of these units are of types which States are unable to utilize for State purposes; are expensive to maintain; are difficult to house; or are very difficult of recruitment during peace. In the War Department General Mobilization Plan none of these units are assigned to the first phase of mobilization, but each has a place in the second phase.

The Militia Bureau has been quite successful this year in obtaining from a considerable number of States the plans for their future organization of all three classes of these deferred units. It must be remembered that these plans may change with each change of State administration. It is felt, however, that if a sound plan has once been worked out in any particular State, it will, ordinarily, be allowed to stand indefinitely unless, perhaps, certain modifications are absolutely necessary. With reference to those deferred units (and in order to strengthen the whole National Guard scheme of expansion for war purposes), the Militia Bureau is now working on a plan which will, it is hoped, insure the assignment to these units, during peace, of the commissioned personnel likely to command, or serve with, such units upon mobilization.

Let us now revert to the plans which I mentioned above as being third, in relative importance. I refer to the plans of States for organizing troops which shall replace their National Guard units called or drafted. It should be remarked that it is not intended to authorize States to raise National Guard units to replace National Guard organizations called or drafted. This being the case, practically all of the States have indicated they will raise their State Guards, State police or State constabulary forces which can be used for the purpose of maintaining and carrying out a definite guard program for the purpose of protecting life and property throughout the States in which they are organized. Troops of this character will be purely State forces over which the Militia Bureau, under existing law, would exercise no control. It is possible, however, that conditions might arise during mobilization or the progress of a war which would warrant Congress in passing legislation such as was passed during

the World War, authorizing the issue to those troops of such rifles and ammunition, cartridge belts, haversacks, canteens, etc., as available supplies then on hand will permit.

Under A. R. 120-10, the Chief of the Militia Bureau is charged with the duty of estimating the approximate number of the above-mentioned articles of equipment which would probably be required to equip such State forces. In order to do this, it was necessary that the Militia Bureau be informed as to the organization, number and types of units which States contemplated raising for the purposes referred to. Accordingly, States were asked to submit their plans for the organization of such State forces and the response has been most gratifying, for to-day we have in the Bureau the plans which nearly all the States have prepared.



Graph Showing Percentage of Units of National Guard Infantry Divisions Organized on September 30, 1924

The plans are not all alike. In a number of the States the organization of such troops has been carefully and thoroughly provided for by State law; in other States the plan proposed is that of the Adjutant General now in office and, of course, the plans which come within the latter class may be modified, or wholly changed, by some succeeding Adjutant General. It is believed, however, that nearly all the States can ultimately be induced to provide by State law for raising forces of this character.

I will only touch upon the fourth, and last, of the plans which the Militia Bureau is endeavoring to have the various States prepare to the end that the National Guard shall function smoothly and efficiently in any mobilization. These are the plans of each State Adjutant General covering the operation of his office in event of mobilization. These plans are analogous to the various branch plans of the War Department, but whether or not they are prepared, or how prepared, is purely a State matter. The only steps which can be taken by the Militia Bureau in connection with their preparation is to point out to the States the advisability of having such plans and to make suggestions as to their form and the points to be covered by each. These suggestions have already been made to the States and the Militia Bureau is advised that in some of the States these plans have been completed or are now in the making.

The process of obtaining all the plans mentioned in this paper is a very slow one. In this connection it must be remembered that the personnel in the office of nearly every State Adjutant General is only barely sufficient to take care of the ordinary routine matters which pass through it. I will also add that, while ordinary routine matters pertaining to the National Guard have increased stupendously during the past three years, in very few instances have State appropriations made it possible to increase the personnel in offices of State Adjutants General. This being the case, the study and work connected with the preparation of mobilization plans is a problem which has to be taken up at such times and in such manner as will least interfere with routine matters which are continually demanding immediate attention. Under such conditions I am agreeably surprised that so much has been accomplished.

Before I leave the subject of mobilization I wish to inject another word or two with reference to the call and draft of National Guard.

War Department Mobilization Plans provide that in event of mobilization the National Guard shall be called into the Federal service upon M-Day, and that on some subsequent date—probably on M-Day plus 30 days—it shall be drafted. This period between call and draft is intended to accord the National Guard an opportunity to accomplish two outstanding things. One is the opportunity to so expand and adjust its commissioned and enlisted personnel that it may, to the fullest degree possible, meet

the requirements of war-time expansion with National Guard personnel. Following its draft this would not be possible, as the draft changes the status of the National Guard from that of National Guard to that of a component of the Army of the United States, and thereafter any personnel required is obtained in the same manner as for the other components of the Army. The other advantage accorded by this period of time between call and draft, is the opportunity given the States to complete before date of draft, the organization of those units which have been assigned a mission in the first phase of mobilization but which were not fully organized and Federally recognized on the date of call or, in other words, on M-Day.

I desire to state here that I am fully convinced that should the National Guard be called for mobilization tomorrow, and should thirty days elapse between the date of call and the date of draft, it would be found upon date of draft with its enlisted personnel at full war strength. The matter of supplying the necessary commissioned personnel to fill all vacancies under a war strength expansion is not so simple a matter to dispose of. There is, nevertheless, a solution to this commissioned personnel problem and the Militia Bureau is working on a plan which, it is hoped, will dispose of it, at least to a very considerable degree.

The General Plan of Organization of Major Units

The general plan of organization for the larger units was to raise in each Corps Area two infantry divisions, or eighteen in all, and in each Army Area one Cavalry division, and a fourth Cavalry division not allocated to any particular army area.

In determining what other army troops and what corps and G. H. Q. troops to allot to the National Guard, the General Staff, which made the original allocations, had several factors to consider.

a. The Corps, Army and G. H. Q. troops needed for the first three field armies were divided amongst the Regular Army, the National Guard, and the Organized Reserves. The latter component was to furnish all these troops for the last three field armies.

b. The particular Corps, Army and G. H. Q. units to be allotted to the National Guard were determined after weighing several considerations, as follows:

(1) The total number of National Guard to be allotted to any State was 800 times the number of its senators and representatives in Congress, as provided in the National Defense Act.

(2) Many States had already begun or completed the organization of certain Corps or Army troops and such were naturally placed in the States' respective allotments.

(3) Many States desired to raise units of a certain character or of a definite designation, because they had furnished the personnel for these particular kinds of units or the units of these particular designations during the World War.

(4) The particular ability of the various States to raise units of a special character and the willingness of the States to accept allotments made.

The actual allotments were made after weighing all these considerations and sometimes after re-adjustments and trading between States following practical trials of the original allotments. It will be seen, therefore, that there is no general plan for the raising of a definite number of complete Corps or of definite components of all the Corps or even of definite components of a selected number of the Corps. Neither is there a plan of any more general application for the raising by the National Guard of Army and G. H. Q. troops. The National Guard allotment of Corps, Army and G. H. Q. troops resulted from the selection of certain units of these forces, which it was believed the States could raise and maintain and which, together with the divisional, coast defense and special allotment troops, would equal the 800 men per senator and representative in Congress.

The coast defense troops were allotted on the basis of organizing in each State the approximate number of coast artillery troops it had prior to the World War. This number, expressed in units, required a total of 130 companies.

These companies have since been reorganized into regiments and separate battalions. Two of the reorganized regiments are 155-mm. gun regiments organized as are the Field Artillery regiments of like character. All other reorganized regiments and all the reorganized battalions are for Harbor Defense.

c. The National Defense Act provided that the minimum strength of the National Guard should be by June 5, 1925, 800 enlisted men per senator and representative in Congress. This would give a total minimum number of 412,800 enlisted or about 435,000 aggregate. By the fall of 1922, it became evident that the development of the National Guard would not be such as to meet the Congressional program considered by many prominent National Guardsmen as *ab initio* too ambitious. I called attention to this fact in an address before the National Guard Association in convention at New Orleans and also made representations to the Secretary of War concerning it.

In order that future efforts of the States would be directed toward first completing those units which would be needed in an emergency, a General Staff Committee was convened to determine what should be the immediate organizational objective in the National Guard. The recommendations of this board, which were approved by the Secretary of War on January 23, 1923, provided for a development of the National Guard to a minimum strength of 250,000 by July 1, 1926. The units to comprise this number were designated and the organization of all others was to be held in abeyance until the completion of this program. The units within this 250,000-man program are as follows:

18 Infantry divisions,
4 Cavalry divisions,
18 155-mm. Field Artillery regiments,
130 Coast Artillery Companies (now organized into regiments or separate battalions),
7 Antiaircraft Artillery regiments,
12 Non-divisional Infantry regiments,

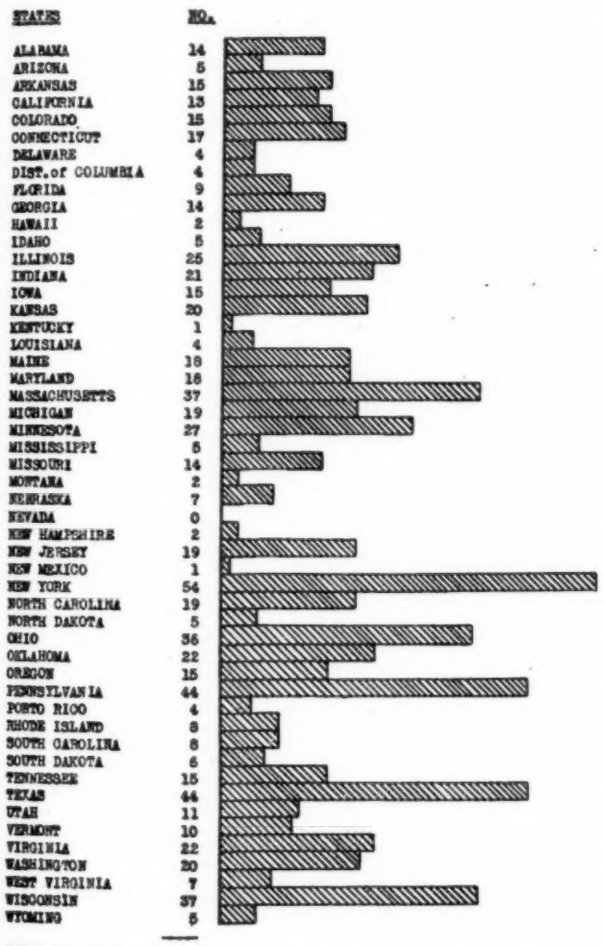
and certain Corps, Army and G. H. Q. units, the organization of which had already begun.

The effect of this restriction has been to concentrate the energies of the States on the definite units, priority in the organization of which is desired. It has given a definite first objective. Whether or not the States can maintain all or any of the units now in the deferred list in addition to those contained in the 250,000-man program can only be determined after the first objective is reached. It is quite likely that this objective, except for a few of the units, like trains and possibly some medical detachments, can be reached at the date set provided Congressional appropriations in sufficient amount for their maintenance are made available.

Under existing conditions the development of the Na-

tional Guard is at a halt. Appropriations for the present year are sufficient only for proper maintenance of an average strength of approximately 177,000, whereas the actual strength on September 30, 1924, was approximately 191,000. This situation has necessitated a suspension of the recognition of all new units and will necessitate a reduction of the total strength of the National Guard to figures considerably below those just mentioned. The effect on morale of halting the development of the National Guard just at a time when it had gained considerable momentum can not yet be accurately determined. It is sure to be hurtful.

Last May, the Militia Bureau conducted a school for State Adjutants General at which a better understanding



Number of National Guard Officers Attending Service Schools, from 1920 to 1924, by States

of the National problems was gained by the State representatives, who, there, had opportunity not only to get more comprehensive ideas as to the important part which the National Guard plays in our scheme of National Defense, but to discuss their own problems and consider solutions of them.

This school, together with amendments to the National Defense Act enacted by the last Congress, coupled with a better distribution than formerly of the expirations of enlistments, has combined to give a considerable impulse to National Guard development. Many States which had initiated new organizations, had expended money in obtaining new armories, and had persuaded indifferent communities into a friendly and sometimes an enthusiastic attitude of support, were compelled on account of lack of Federal funds with which to continue development, to break engagements affecting the whole question of State financial support of the National Guard.

The terms of the order for the suspension of the recognition of additional new units were designed to minimize, as far as possible, the evil results just mentioned, but this attempt was only partially successful. Communities that had been induced to spend their money and time in the initial stages of organizing units, only to find that the Federal Government would have nothing to do with them after all, will be difficult to convince and win over to any future support for such units. As a result the Federal Government has been placed in the position of one who plays fast and loose with the States; and this may tend to retard future development even though the present suspension of recognition of new units is eventually raised.

Supply and Equipment

The armament, equipment, and uniform of the National Guard is the same as that provided for the Regular Army and it is so equipped, with few exceptions. It is equipped for peace strength during peace time. While some organizations are not recruited up to peace strength units average 74 per cent of their peace strength. Full peace strength equipment is issued and the difference between the actual requirements for peace strength and for training purposes is in storage in State warehouses. There are, however, several States which have not the facilities for storing equipment and the organizations are equipped only at maintenance strength. The balance of the equipment is in reserve and available at any time, the difference being that the balance is stored in Regular Army warehouses instead of those of the State.

The exceptions noted above are such supplies as are not usually needed for peace time training and other articles not now on hand and for the procurement of which there are no available funds, such as animals, motor vehicles, and certain technical signal and other equipment. The present allowance of horses for armory drill training is approximately 25 per cent of the total number required for full equipment of peace strength, which is 57,000, approximately 10,000 of which have been issued. The full supply for armory drill training is approximately 16,000 for the present number of National Guard units. Mules are not issued in peace time. It is estimated that 88,096 horses and 65,652 mules will be required, in addition to those now on hand, to equip the National Guard at war strength. The number of motor vehicles of all kinds required, except passenger cars, trailers, and motor-cycles, to equip the National Guard is 5,653, approximately one-half of which have been issued. About 35 per cent of the requirement as to passenger cars and motor-cycles have been issued.

The method of supplying peace-time requirement is as follows: Requisitions for all classes of supplies, except motor vehicles, animals, and technical equipment, are forwarded by organizations through corps area headquarters to supply depots, shipment being made direct to organizations. Shipping tickets are sent to the State property and disbursing officers who become the accountable officers, while organization commanders are held responsible and carry the property on memorandum receipt. Requisitions for the excepted articles are sent direct to the Militia Bureau.

When mobilization is ordered, requisitions covering the

difference between peace and war strength equipment are forwarded to the respective Corps Area Commanders who send these requisitions to the proper supply depots with shipping instructions.

Training

The policies controlling National Guard training are prepared by a committee of the General Staff as provided for in the National Defense Act, and are then promulgated by the Chief, Militia Bureau, to Corps Area Commanders, the latter being charged with the supervision of National Guard training. The responsibility for training the National Guard rests with the States, but the Federal Government assists in this training by furnishing to the States various types of aid. In addition to the matériel, supplies and funds, a highly important type of aid in such training is the Regular Army personnel detailed for duty with the National Guard. Whereas the responsibility for furnishing or recommending the aid needed in training rests upon the Chief, Militia Bureau, the more detailed supervision of such training is a function of Corps Area Commanders, as provided for in General Orders No. 5, War Department, 1923. Thus, the supervision is decentralized, and the reasons therefor are obvious. On the staff of the Corps Area Commander is a staff officer designated as officer in charge of National Guard affairs, whose functions are mainly those of adviser to the Corps Area Commander regarding National Guard matters. He usually has an assistant and three or four clerks. At some headquarters practically all National Guard questions are handled by him; at other headquarters his functions are more general, the General Staff and Services performing duties with reference to the National Guard much as they are performed with respect to other activities.

Instructors are under the control of Corps Area Commanders and constitute the agents of the Corps Area Commander for the execution of his supervisory duties. In addition, they give the fullest direct assistance toward helping the National Guard to meet its responsibilities. Instructors are of two general classes: division instructors and instructors with organizations. Division instructors are for the purpose of assisting and advising the division commander, giving instructions to the staffs of organizations higher than the regiment, as well as for supervising the instruction of divisional units not otherwise provided for, as, for example, the signal company, military police company and other like units. Instructors with organizations are those who work with commanders of, or within, regiments or separate units less than the regiment. To the main combat arms within a single State, two to four instructors are allotted to each regiment; with special units, comprised within a single Corps Area but in more than one of the States thereof an instructor has functions relating to organizations generally at large in the Corps Area. An example of this is a Medical Regiment located in more than one or perhaps in all the States of the Corps Area.

Instructors are allotted by arm to States, as far as may be practicable in accordance with the average distance to be traveled by an instructor of that arm in making one trip to the units under his instructional supervision. The average distance to be traveled and the average number of units per instructor furnishes an equitable basis for the distribution of instructors. The present total allotment is 485 officers as instructors and 601 sergeant instructors. To meet the present reasonable minimum needs of the National Guard there should be 590 instructors and 675 sergeant instructors. The detail of sergeant instructors is made on about the same ratio as officers. Where company or similar organizations assigned to an instructor are separated, a sergeant is normally placed at a station different from the station of the instructor. The above allotment of 485 officers covers all assignments now made in connection with the National Guard, including those to the Militia Bureau and Corps Area Headquarters.

National Guard training is divided into two periods, armory and field training. The former comprises the entire year, with the exception of 15 days allowed in camp for field training and usually two short instruction periods: one of four days, where those officers who are able to attend are given administrative, technical and tactical training; and a six day period where selected officers and men attend a camp of rifle instruction.

The average amount of training for company or similar organizations is approximately 150 hours a year, divided about equally between the armory and the summer camp. The law requires each company or similar unit to have at least 48 assemblies per year for drill and instruction in the armory period, and at least 15 days in camp, whenever practicable. Ordinarily organizations larger than the company are not trained as such during the armory period, such training being done in camp.

Policies with reference to the training of National Guard center around a few cardinal principles which are as follows: An annual training objective for each unit in a State; progressive development throughout the year in order to attain the desired objective, the latter being reached at the culmination of camp; field training should be a progressive continuation, not a repetition, of that given during the armory period. The training directive is issued to Corps Area Commanders at such a date as will enable them to announce the training scheme for the National Guard of their Corps Areas and have such announcement reach each State sufficiently early to permit of its being communicated to the highest tactical commander or commanders of the troops of each State prior to the termination of the field training period. It is desired to have each battalion or similar commander receive during camp, a statement as to the objective to be striven for as the culmination of the next year's work. With this established each company or similar commander will have knowledge of what he is to aim for and can map out his program accordingly before his organization actually enters upon its succeeding armory work.

The above has had reference to organizational training only. The separate training of officers, noncommissioned officers and specialists is provided for in schools. For enlisted men such training must be largely confined to instructional periods at home stations. Officers are instructed through correspondence courses and at the different service schools. It will be appreciated that both funds and facilities will permit only a very limited number to attend service schools.

With reference to schools at home stations, other than instruction by correspondence, it will be seen that systematic personal instruction by instructors is impossible due to the number of stations in the National Guard and the number of available instructors. The stations number about 1,400 and commissioned instructors allotted do not exceed 440. In certain large centers, due to the number of organizations located thereat, a number are grouped. A majority of the stations are without instructors and many National Guard officers have no chance for frequent touch with instructors. Correspondence instruction is necessarily unsatisfactory. An indi-

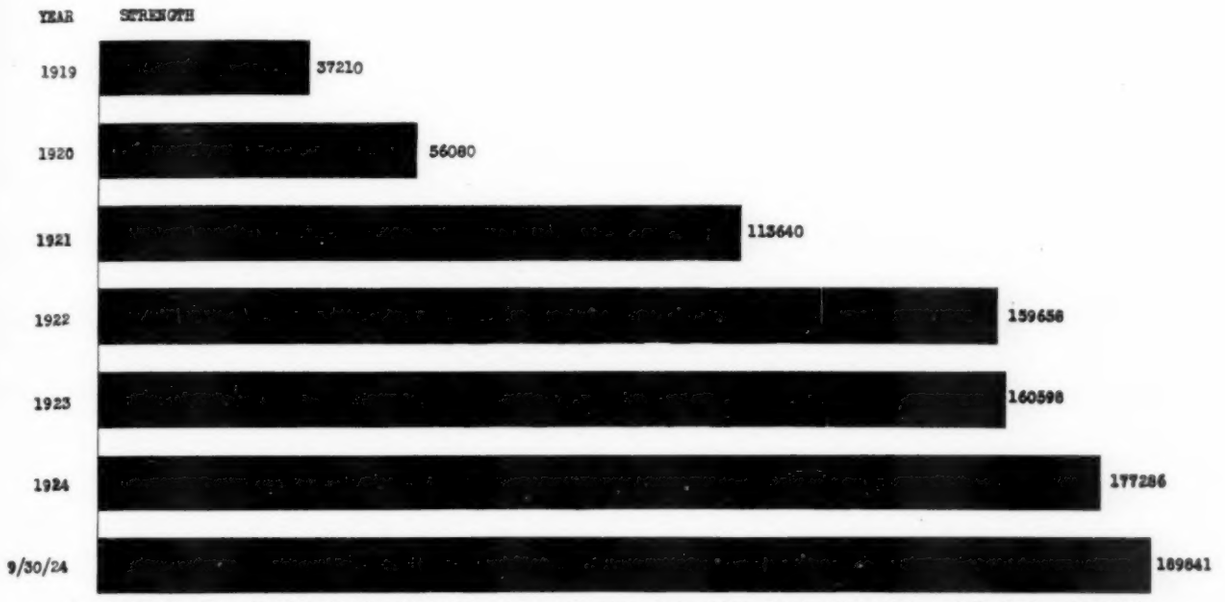


Chart Showing Strength of the National Guard as of June 30, 1919, 1920, 1921, 1922, 1923, 1924, and September 30, 1924

vidual who is occupied with his daily business pursuits does not usually feel inclined to devote his evenings to study, especially if there are not others at his station with whom he can easily join for the purpose of common study. Field officers generally find little opportunity for satisfactory applicable instruction. In the armory season there is practically no chance for them to train their units and supervision of company training does not answer the purpose of training in their own grades. During the present school year courses for field officers are being provided at the special service schools; but due to shortage of funds the number who can attend will be very small.

Training in the National Guard is further hampered by the annual "turnover" in personnel. For officers annual separations amount to about 35 per cent, with something over 90 per cent of the number being in company grades. For enlisted men the annual separation is approximately 45 per cent.

It will be seen, therefore, that progressive development year by year to a final stage of profitable training for the largest units, that is, brigades and divisions, is not to be expected. Assembly of brigades and divisions is not at all difficult. However, to attempt to train them for efficient tactical operation as organizations would be to consume the annual field training period at the expense of progress in lower organizations. It is believed that the training by brigade and division commanders and staffs will be best accomplished by means of terrain exercises during the period of encampments.

Mobilization training will depend upon the peace developed efficiency of the commissioned cadres. The principles set forth for the training development of the National Guard while in State service are believed to be sound and the extent to which efficiency in training may be developed is dependent entirely upon the amount of time available to National Guard personnel. The provisions of Federal law are being carried out; but administrative requirements demand a great deal of the time available to those responsible for the development of organizations. It is felt that the average officer in the National Guard cannot devote more time to his military work than is now being done and the rounding out of organizations must be left to that period of time available after M-Day and before actual combat service will be required.

Under the plan for National Defense the National Guard will constitute first line troops to be called out on M-Day. This contingent is to be twice the strength of the Regular Army. These two contingents must be the Nation's reliance until the reserves are fitted to take up their duties against the enemy, a period variously estimated at from three to six months after D-Day. It is not at all impossible that before the reserves are ready to function a real crisis may confront the field forces composed of the Regular Army and the National Guard. If the National Guard should fail, then it is not likely that the remaining one-third, the Regular Army, can bear the entire brunt of the combat. In that event the war might end before the reserves could be made ready. In other words, upon the efficiency of the National Guard may depend the Nation's safety. The answer is to make the National Guard as efficient as possible. This will depend primarily on Federal aid and the quality of that aid. To me the most important thing is to furnish well qualified instructors. A proper number of instructors is, of course, necessary, but numbers will mean little unless they have a high order of efficiency. Since the organizations of the National Guard are living units and will be used as such in the emergency, their ability to perform their required missions will, in the last analysis, depend primarily on the quality of instructional aid given them by the Federal Government. Only the best can produce the development to be hoped for.

Present Problems of the National Guard

The principal problem of the National Guard today is to find a means of temporarily reducing the strength of the Guard without seriously affecting its morale. Several propositions are being considered, namely:—

a. The reduction of all units to a small per cent above maintenance strength.

b. The reduction of the strength of all States to a small per cent above the maintenance strength of their combined units.

c. The authorization of furloughs to all over the necessary maintenance strength or to all over a small per cent above maintenance strength.

Other problems before the National Guard are:—

a. The determination of the means of providing a practicable, satisfactory and economic National Guard Reserve.

b. The coordination of requirements for commission in the various grades between the National Guard and the Officers' Reserve Corps.

c. The qualification and designation in advance of the additional commissioned personnel required to place the National Guard on a war footing.

d. The regrouping of units in the Cavalry Division to effect a lesser dispersion.

The solution of these problems has been undertaken by the Militia Bureau with every prospect of success. In addition, the Militia Bureau has its own additional problems of completing a general revision of National Guard Regulations, new organization tables, new equipment tables; a compilation of statistics, mobilization plans and historical records.

There are no serious conflicts between Federal and State interests. Federal interests demand a balanced organization which requires certain units of a character of little use from a State standpoint. Although such units are the more difficult to raise, the States on the whole have done their part. As already stated, such organizations are permitted to be armed with rifles in addition to their proper arms, when the States so request, in order that they may be used by the States in local emergencies.

In training the tactical units that are divided amongst two or more States, Federal interests are somewhat adversely affected because these units are actually under the command of officers belonging to different sovereignties. On the whole, however, the States, though not surrendering their right to command their own troops, have in many cases adjusted the matter of command where the troops of more than one State are brought together in a single camp, by the junior commanders agreeing to conform to the will of the senior. No orders are actually issued to the junior command, but the senior's requests that specific orders be issued are always executed.

Morale and Dependability

Those who have recently seen the National Guard in camp must have been impressed with the high morale and the general attitude of discipline, orderliness, cleanliness, neatness of dress and business-like appearance of these citizen soldiers. By the nature of things these men lack much in training. Few units would be ready at once for active field service against a powerful enemy. Most of the older organizations would need at least a month of intensive training and the others would need more before they could properly fulfill the war mission of the National Guard. If this length of time be available to complete its essential training the National Guard can be depended on as an effective component of the Army of the United States.

The National Guard in the Army of the United States

The Regular Army is so small and, in a major emergency, must itself undergo such expansion and reorganization that the initial attitude of the United States must be defensive. During the initial stages of a major emergency the Regular Army and certain parts of the National Guard might be called on for active defensive operations and the necessary intensive training of part of the National Guard might have been had at the front; but this situation cannot be avoided and is realized with all seriousness by the National Guard itself. There is no other sufficient force for first-line troops in a major emergency. From necessity the Guard has been placed in the first line. Therefore, everything that can be done to advance the preparedness of this force in time of peace should be done.

The priority of use of the National Guard and the Organized Reserves should be kept in mind constantly. The units of the latter force in any locality should be as completely organized as can be done consistent with non-interference with the organization of the National Guard. The organization of both components can usually go hand-in-hand, but in small communites the situation may be different. There should be no bidding against each other for non-commissioned officer or specialist personnel, but the priority of use should be kept in mind and the organization of the Reserve unit in the small community, which also supports a National Guard unit, should be retarded in the rare instances where the development of one may interfere with the proper organization of the other.

This is my conception of team play. The proper play of the whole team, composed of the Regular Army, the National Guard, and the Organized Reserves, will be necessary to materialize the dreams of those who conceived the National Defense Act.

American Chemical Society to Be Guests of Army Ordnance

THE members of the American Chemical Society who will hold their annual meeting in Baltimore, Md., April 4-11, 1925, have been invited by Maj. Gen. C. C. Williams, Chief of Ordnance, to be present at a demonstration of ordnance proof firing at the Aberdeen Proving Ground on the afternoon of Thursday, April 9th. It is expected that a large delegation from the members of the Society attending the meeting will make the trip to the Proving Ground.

The greater part of the demonstration will feature the chemistry of ordnance. Most of the chemists of the country are familiar with the tremendous chemical requirements of the Ordnance Department in war time. The Ordnance needs for heavy chemicals and explosives created a gigantic demand to which the chemical industry of America responded nobly.

Picatinny Arsenal and Frankford Arsenal, the two main Ordnance establishments where chemical development work is under way, will give exhibitions of their latest research, including developments in smokeless powder manufacture, pyrotechnics, small arms ammunition, and other kindred material. Col. Odus C. Horney, Commanding Officer at Frankford Arsenal, has arranged to display an interesting series of exhibits showing sectionalized small arms ammunition and other armament manufactured at that Arsenal. Maj. N. F. Ramsey, Commanding Officer at Picatinny Arsenal, has arranged for a demonstration of propellants and other chemicals and their manufacturing processes.

This will be an excellent opportunity for the chemists of the country, through their national organization, the American Chemical Society, to view the important work under way by the Ordnance Department in the development and manufacture of ammunition, explosives and pyrotechnics. It is hoped that all members of the Society who attend the Baltimore convention as well as those who live in nearby localities will avail themselves of the opportunity to witness this interesting demonstration at the Aberdeen Proving Ground.

Modern Small Arms and Their Uses

PART I

By

GLENN P. WILHELM

UNITED States Army Field Service Regulations state that the combatant arms are the Infantry, the Artillery, the Cavalry, the Signal Corps, the Engineers and the Air Service. These regulations also state that no one arm wins battles, that the combined employment of all arms is essential to success and that the coordinating principle which underlies the employment of the combined arms is that the mission of the Infantry is the general mission of the entire forces. Anything that will assist the Infantry is, therefore, of the greatest utility as *"L'Infantry c'est l'armee."*

Major Glenn P. Wilhelm

It will be noted that of the combatant arms of the Service, three of the more important arms are equipped with small arms as their primary armament. These three are the Infantry, the Air Service and the Cavalry. It is true also that the remaining combatant arms use small arms as a secondary part of their equipment.

Of these combatant arms, the Infantry, at the present time, is the basic arm, and if the claims of our Air Service prophets are realized, in the near future, the Air Service will become the basic arm. The importance, therefore, of small arms can readily be seen inasmuch as they constitute the primary armament of these two basic branches of the military service. Moreover, there is a general interest of individuals in small arms to the extent that there is an annual competition at Camp Perry known as the "National Rifle Matches" in which, besides teams from the Army, Navy, Marine Corps, National Guard, R. O. T. C. and C. M. T. C., there are also representatives from rifle clubs and individuals throughout the country. All of this means that small arms are of universal interest and importance to everyone connected with the military and naval services and to the country at large.

In this connection the Ordnance Department of the Army is charged with the procurement, including design, manufacture, issue and supply, of all small arms and small arms ammunition to not only the Army, but also to the Navy and Marine Corps. By small arms and small arms ammunition are meant all armament, and the ammunition therefor, up to the smallest type of artillery; namely, the 37-mm. As a matter of fact, the small Arms Division of the Ordnance Office is charged with the development of the automatic aircraft 37-mm. gun, so that the tendency of late has been to classify all automatic weapons of whatever caliber as small arms.

War Record of Small Arms

The record made during the War by the Ordnance Department in connection with small arms is splendid. For instance, the A. E. F. used our own rifles and rifle ammunition. In fact, the only deficiency in small arms was the necessity for arming the A. E. F. in the beginning with machine guns and machine gun ammunition of makes other than American. Our pistol, as well as our rifle, was probably the best used by any Army.

Up until the World War the principal weapons of the Infantry, or rather the only weapons of the Infantry, were the rifle with its bayonet, and the pistol or revolver, as the machine gun was merely tolerated and generally looked upon with suspicion. During the War the Infantry gradually acquired to itself weapons of all kinds, including artillery types, such as the trench mortar and the 37-mm. gun, so that an Infantry brigade was a miniature army. The principal weapon acquired by the Infantry, however, and which now ranks almost with the rifle, was the machine gun.

Comparison of War Time Status of Small Arms and Post-War Development

The best idea that can be obtained of the post-war development of small arms as compared to the World War weapons is by a study of what took place during the War and what will probably take place in the next war as a result of after-war development. Taking the last year of the war as the basis for this study, it will be noted that the Infantry possessed the Springfield rifle, which, of course, is hand operated, and a machine gun firing an ammunition which was limited in effective range to about 2,000 yards, with practically no other means of defense against low flying attack airplanes, except these

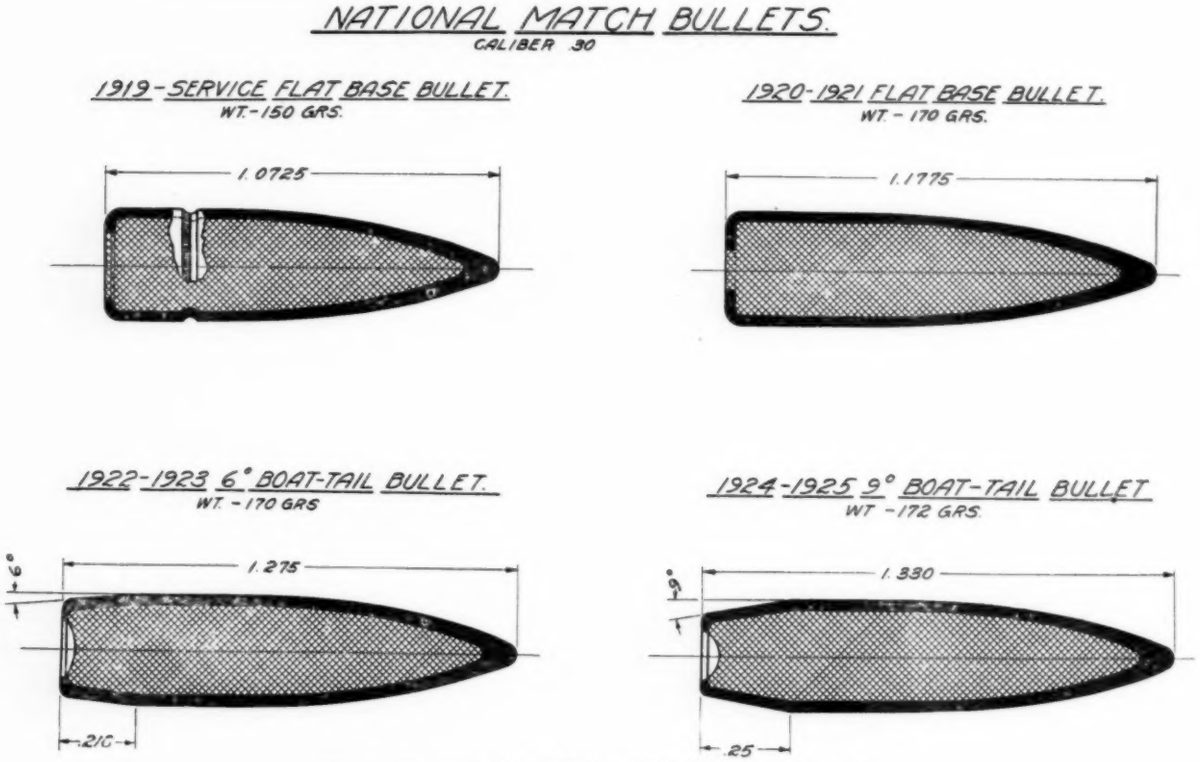


Fig. 1. Characteristics of National Match Bullets Caliber .30

weapons. Antiaircraft tripods were either crude or nonexistent. Airplanes in themselves were armed with aircraft machine guns firing tracer ammunition. In general, there were two types of aircraft machine guns; one being a fixed gun which could only be aimed by shifting the entire plane, and which fired through the propeller by means of a synchronized gear so that each shot always passed through the spaces between the propeller blades, the other gun was known as the flexible gun and was fired by an observer who had the free use of his gun for firing in any direction. The tracer ammunition used by both types was very erratic in flight, gave a large percentage of blinds and was extremely inaccurate. Its visibility and length of trace were very limited.

In the next war we are told that planes will unmercifully punish columns of men by reason of their ability to fly low. This prediction is based upon the lack of success of ground troops to adequately cope with low flying planes in the World War. Such predictions are based upon post-war improvement in planes, but they ignore post-war development in small arms.

Infantry and Small Caliber Weapons for Antiaircraft Uses

When an attack plane, equipped with machine guns and small bombs, flies low over Infantry troops in the next war, here is what it will encounter: First, semiautomatic Infantry rifle fire; second, caliber .30 machine guns mounted and sighted properly for antiaircraft fire and using tracer ammunition of extremely flat trajectory, great brilliance, long length of trace, small percentage of blinds and great accuracy, as well as efficient incendiary effect; third, caliber .50 machine guns suitably mounted and sighted for antiaircraft fire, using a combination armor-piereing tracer ammunition with great range and extreme brilliance, long length of trace with all the characteristics outlined for the caliber .30 tracer; fourth, automatic 37-mm. guns of very high velocity, firing shells with supersensitive fuzes, and which are laid upon planes by means of very brilliant tracing compounds in the base of the shells. In other words, when planes fly lower than they can be profitably taken care of by true antiaircraft artillery, small arms will make it hot for them.

Infantry Weapons and Normal Tactical Use

Semiautomatic Rifles

Infantry, in the next war, will undoubtedly be equipped, if the war is of any considerable duration, with semiautomatic shoulder rifles. Two types of caliber .30 semiautomatic rifles have so far been developed and will be tested by the Infantry and Cavalry in the near future. The advantage of these types of weapons over the time-tried Springfield rifle is in the fact that they are operated semiautomatically, thus requiring less effort on the part of the firer and greatly increasing the time that is available for sighting, yet still maintaining the same rate of fire. In an emergency, the rate of fire can be very greatly increased over that which is possible with the Springfield.

One of these types of rifles has been developed by the Ordnance Department and is called "The Garand," after the inventor, Mr. John C. Garand. It is operated by the set-back of the primer acting through the firing pin to unlock the bolt, and allowing the breech mechanism to function in extracting, ejecting and reloading.

The other semiautomatic is known as the Thompson auto rifle and is based upon the wedge, or Blish, principle. (After Commander Blish, U. S. Navy.) This system consists of a wedge slidably located in a bolt, which, due to the inertia of the masses involved, the friction of the sliding surfaces and the briefness of the time interval, automatically slides out of place and unlocks the bolt. In the case of the caliber .30, the wedge consists of its

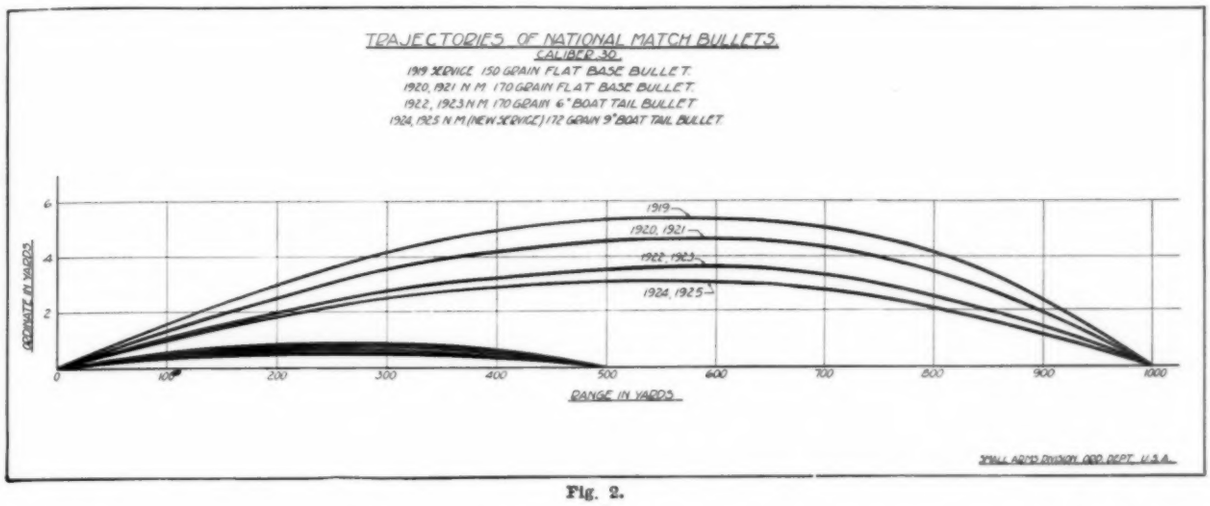

TRAJECTORIES OF NATIONAL MATCH BULLETS.
CALIBER .30.
1919 SERVICE 150 GRAIN FLAT BASE BULLET.
1920, 1921 N.M. 170 GRAIN FLAT BASE BULLET.
1922, 1923 N.M. 170 GRAIN 6° BOAT TAIL BULLET.
1924, 1925 N.M. (NEW SERVICE) 172 GRAIN 9° BOAT TAIL BULLET.
1919
1920, 1921
1922, 1923
1924, 1925
ORDINATE IN YARDS.
RANGE IN YARDS.
SMALL ARMS DIVISION, ORD. DEPT. U.S.A.

Fig. 2.

mechanical equivalent, the screw, in combination with a rotating bolt mechanism.

In addition to these two types of caliber .30 semiautomatic rifles, the Ordnance Department is developing a semiautomatic shoulder rifle of slightly less caliber, at present named "The Pedersen," after the inventor, which has the following advantages over the caliber .30:

First: The weight and length of the rifle does not exceed that of the Springfield.

Second: The amount of ammunition carried by the soldier for a given weight is nearly doubled, while the rate of fire and the time during which fire can be sustained, due to the less power of the cartridge, is also doubled.

This rifle incorporates a great many features which are usually considered ideal, but which are rarely found in military weapons. It has the advantage of supplying the Infanrty with a semiautomatic rifle which has as great a range as will ever be called upon to be used in battle; i. e., 1,000 yards, and which does not involve carrying around a semiautomatic rifle and ammunition of greater weight than is necessary to obtain this range.

Machine Guns

Our Infanrty, in the next war, will probably be equipped with the same caliber .30 machine guns as were issued to some divisions in the latter stages of the World War; i. e., the Browning machine gun with slight modifications. No one has been able to improve upon this gun up to the present date, with the exception of making improvements of a minor nature.

The present standard antiaircraft gun in use by antiaircraft units is the caliber .30 Browning. These guns will probably be replaced in the future, as fast as funds become available, with the Browning machine gun, caliber .50. The caliber .50 gun is merely a big brother of the caliber .30, being identical in design (except minor improvements), rate of fire and shape. Its size and weight, of course, are considerably greater. The big advantage of the caliber .50 over the caliber .30 is its much greater effective range and striking energy, as increasing the caliber 40 per cent increases the weight of the bullet 500 per cent.

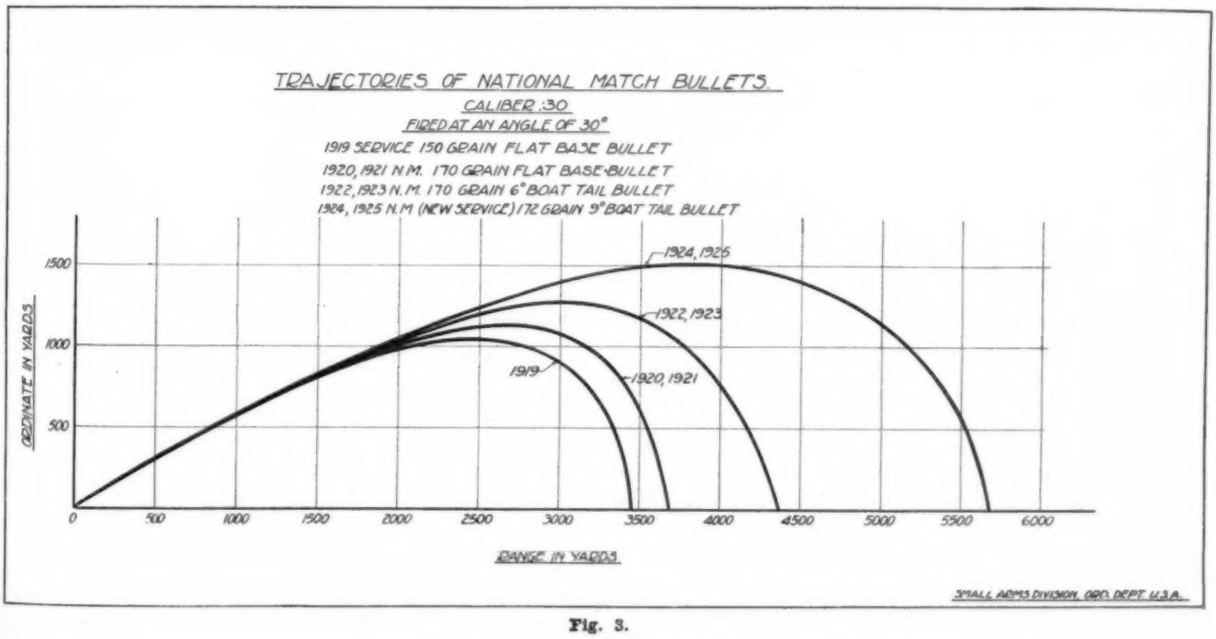

TRAJECTORIES OF NATIONAL MATCH BULLETS.
CALIBER .30
FIRED AT AN ANGLE OF 30°
1919 SERVICE 150 GRAIN FLAT BASE BULLET
1920, 1921 N.M. 170 GRAIN FLAT BASE BULLET
1922, 1923 N.M. 170 GRAIN 6° BOAT TAIL BULLET
1924, 1925 N.M. (NEW SERVICE) 172 GRAIN 9° BOAT TAIL BULLET
1924, 1925
1922, 1923
1919
1920, 1921
ORDINATE IN YARDS.
RANGE IN YARDS.
SMALL ARMS DIVISION, ORD. DEPT. U.S.A.

Fig. 3.

Aircraft Armament

Browning Machine Gun, Caliber .30

In the next war our Air Service will probably use Browning machine guns, caliber .30, aircraft type, for both fixed and flexible use. This gun is far superior to the numerous types used during the World War, a number of which are still on hand. To adapt the Browning to flexible use required the development of two alternatives, both involving the elimination of the canvas web cartridge belt. This old type of belt was impracticable to fire in the air by reason of the effect of the air stream on a belt of this nature. These alternatives are: First, the use of metallic links which separate as fast as the cartridges are fed; second, the use of a metallic box magazine.

Another aircraft machine gun development is the use of two Browning machine guns in pairs, one having a right hand feed, and one having a left hand feed.

Browning Machine Gun, Caliber .50

Certain types of airplanes, such as pursuit planes, will be equipped with a caliber .50 machine gun. Still other planes will be equipped with automatic 37-mm. guns with velocities as high as 2,000 f. s. Compare this to the present Infantry 37-mm. nonautomatic gun for ground use of 1,100 to 1,300 f. s. The requirement of 2,000 f. s. in an aircraft gun was based on the tactical use of attack planes against tanks at short ranges. A smaller velocity would fail in giving effective penetration.

The Automatic 37-mm. Gun

In the tentative designs so far submitted for automatic 37-mm. guns, two principles have been followed; they are: (1) The machine gun principle; (2) The cannon principle.

By machine gun principle is meant one involving a breech mechanism which has a length of travel to the rear sufficient to clear the overall length of the cartridge case and projectile, as distinguished from the cannon principle of a falling or similar type of block which either drops or remains in the immediate vicinity of the chamber. In the case of the smaller cartridges, the machine gun principle is the superior, but on account of the great length of receiver required for the larger calibers, it becomes impracticable.

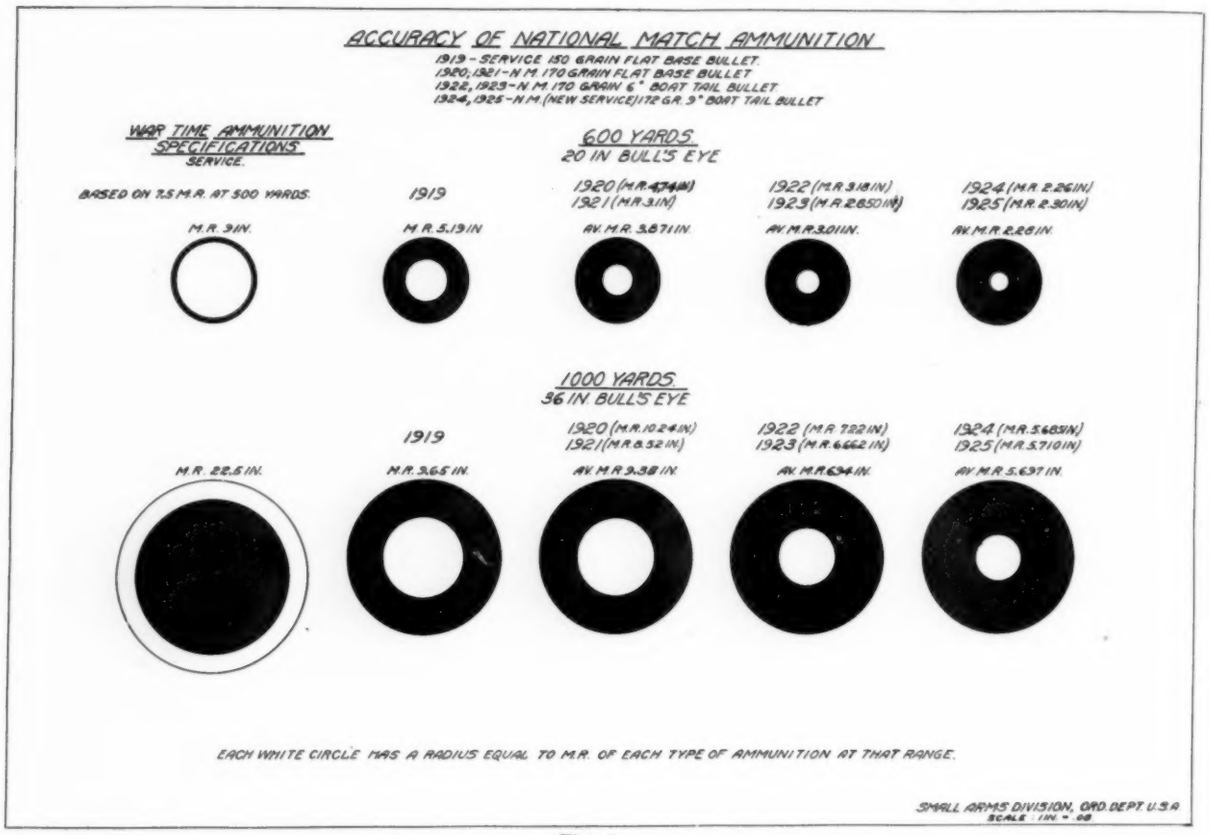

ACCURACY OF NATIONAL MATCH AMMUNITION
1919 - SERVICE 150 GRAIN FLAT BASE BULLET.
1920, 1921 - N.M. 170 GRAIN FLAT BASE BULLET.
1922, 1923 - N.M. 170 GRAIN 6° BOAT TAIL BULLET.
1924, 1925 - N.M. (NEW SERVICE) 172 GR. 9° BOAT TAIL BULLET.
WAR TIME AMMUNITION SPECIFICATIONS SERVICE.
600 YARDS 20 IN BULL'S EYE
BASED ON 7.5 M.R. AT 500 YARDS.
1919
1920 (M.R. 4.74 IN.) 1921 (M.R. 3 IN.)
1922 (M.R. 3.18 IN.) 1923 (M.R. 2.850 IN.)
1924 (M.R. 2.26 IN.) 1925 (M.R. 2.30 IN.)
M.R. 9 IN.
M.R. 5.19 IN.
AV. M.R. 3.871 IN.
AV. M.R. 3.011 IN.
AV. M.R. 2.26 IN.
1000 YARDS 36 IN. BULL'S EYE
1919
1920 (M.R. 10.24 IN.) 1921 (M.R. 8.52 IN.)
1922 (M.R. 7.22 IN.) 1923 (M.R. 6.662 IN.)
1924 (M.R. 5.685 IN.) 1925 (M.R. 5.710 IN.)
M.R. 22.5 IN.
M.R. 9.65 IN.
AV. M.R. 9.38 IN.
AV. M.R. 6.94 IN.
AV. M.R. 5.697 IN.
EACH WHITE CIRCLE HAS A RADIUS EQUAL TO M.R. OF EACH TYPE OF AMMUNITION AT THAT RANGE.
SMALL ARMS DIVISION, ORD. DEPT. U.S.A.
SCALE 1 IN. = 6 8

Fig. 4.

Improved Types of Small Arms Ammunition

New Service Ammunition and the Boat-tailed Bullet

Striking improvements have been made in small arms ammunition. The most noteworthy of these is that of the caliber .30 bullet, and, in fact, the entire caliber .30 cartridge. The new bullet, when loaded in the case, apparently is the same as the old one, except the color, which is copper. This color is due to the use of the gilding metal jacket composed of 90 per cent copper and 10 per cent tin, which has been substituted for the cupronickel jacket formerly used. This change has been made for purposes of uniformity in manufacture and to eliminate metal fouling. When the unassembled bullet is examined, however, it will be noted that it is considerably longer than the old and has a tapered base ¼-inch long at a 9° angle. The use of this tapered base increases the weight of the bullet from 150 grains to 172 grains. This new bullet is fired at the same muzzle velocity as the old; namely, 2,700 f. s., and this is accomplished without any increase in allowable pressure by the use of a more progressive burning powder. Ordinarily increasing the weight of the bullet 22 grains, and maintaining the same

velocity would necessarily involve an increase in pressure. The effect of the tapered base on the new bullet is to give it an increase in maximum range from less than 3,500 yards with the old bullet to about 5,500 yards with the new bullet. At 1,000 yards' range, the new bullet requires ten minutes less elevation than the old. This means that when a rifle is sighted for the bull's-eye with the present service ammunition, with the new service ammunition it will strike about eleven feet higher, thus clearing the top of the entire target by about six feet.

The reason the tapered base increases the range is because the air resistance of the bullet has been decreased, particularly at the lower velocities where its stream line properties become more effective.

The important stages in the development of the new ammunition are best understood by reference to Fig. 1, which shows four types of National Match bullets. While there were minor differences between bullets of the same type (the 1921 bullet was tin plated), yet the types remain essentially as represented.

The National Matches were used as a great service testing ground in the development of new ammunition, as, in this way, several million rounds of each improved type could be tested by the best shots of the country.

The 1919 National Match bullet is the present service bullet, while the 1924-25 will be the new service bullet. The 1919 National Match ammunition was selected from millions of rounds of ammunition produced in war time. All other types were manufactured for the National Matches in quantities of approximately 2,000,000 rounds.

A comparison of the trajectories and the ranging efficiencies of these bullets is shown in Figures 2 and 3. Fig. 2 shows all four trajectories at short range; i. e., 500 and 1,000 yards, the highest trajectory always representing the old service and the lowest the new service. Fig. 3 gives a comparison of the ranges obtained with each type at the same elevation of 30 degrees. This is approximately the extreme range of each.

This new type of ammunition is particularly valuable for long range machine gun barrages, and for the rifle on account of its increased accuracy and flatness of trajectory, thus increasing the danger space. For rifle use, however, it is subject to the disadvantage that it is unnecessarily heavy and unnecessarily powerful for Infantry battle ranges which rarely exceed 600 yards.

The improvements in accuracy of the new ammunition are as remarkable as the increase in range. The accuracy of the new ammunition is almost as good at 1,000 yards as the old was at 500 yards.

Fig. 4 shows the comparison in accuracy of each of the four types at 600 and 1,000 yards as shown by National Match ammunition tests. As a basis of comparison, the war time ammunition specifications are shown at the left.

The upper row of black circles represents the 20-inch bull's-eye at 600 yards, while the lower row represents the 36-inch bull's-eye at 1,000 yards. Each white circle is drawn with a radius equal to the mean radius of each type of bullet at that range. The decreasing size of the white circles from left to right shows the astonishing increase in accuracy. It is doubtful if the circles ever grow much smaller.

All types of ammunition were made in quantity by production methods and are not in any sense of the word special or hand-loaded ammunition.

It is considered that this chart is to the everlasting credit of the manufacturing ability of Frankford Arsenal to produce small arms ammunition in quantity equal in accuracy to special Match ammunition, and exceeding in range the best previous military types of bullets.

Tracer Ammunition, Caliber .30 and Caliber .50

The next most striking small arms ammunition development has been with caliber .30 and caliber .50 tracer ammunition. Not only has the Air Service been furnished with a new calbier .30 tracer which is superior to the old type in every respect, but the Infantry and other combat branches of the Army, including antiaircraft batteries, are being furnished with very superior types of tracer. For instance, the Infantry now has tracer ammunition in two colors: red and white. The idea of the two colors is that against some backgrounds one can be used for greater visibility than will be possible with the other. Against a blue sky, the white tracer is more visible, while against a grey or white overcast sky, the red is the more visible. Also there is the possibility that the Infantry will use one color of tracer for fire control leaders, and the other color for the individual rifleman, thus targets will be designated, the range determined and the fire of the unit directed and controlled by the platoon leader.

Tracer ammunition of still greater ranges for long range machine gun fire and range finding, as well as for antiaircraft fire, is still under development. The difficulty is in daylight visibility at the longer ranges. The present new types of caliber .30 tracer are quite visible at 1,000 yards. However, when these types are viewed at 2,000 yards, they become invisible, although they actually may be as bright at 2,000 as at 1,000. An electric arc lamp many times larger than a tracer flame of ⅓-inch in diameter is quite invisible at 2,000 yards in daylight.

The tracer obtains the visibility it does now by the length of the flame which shoots from the rear of the bullet, and which makes up, in some part, for its lack of diameter. Tracer bullets have one thing in common with boat-tail bullets in that the bullet, when it traces, ranges farther than it does when it fails to light. This is probably not so much a rocket effect, as a stream line effect, due to the gases filling up the vacuum which ordinarily is in the rear of the bullet.

Pistol Tracer

An interesting tracer development is a recent one of the caliber .45 pistol ball. A very brilliant trace is obtained for a range of about 2,000 feet. It has the advantage of using the present caliber .45 automatic pistol and enables anyone equipped with this sidearm to utilize an efficient bullet for signalling, illuminating, tracing and incendiary effect.

Armor-Piercing Ammunition

Remarkable armor-piercing ammunition, particularly in caliber .30, is now a standard for manufacture. A penetration for the caliber .30 in tank armor plate of about .6-inch has been obtained. This means that the tank armor used in the World War could have been penetrated by caliber .30 bullets. This, however, does not make the caliber .30 an effective antitank weapon.

In the case of the caliber .50, armor-piercing ammunition has been adopted as a standard which will penetrate an inch of armor. However, since this weapon is not considered as an antitank weapon, but rather as an antiaircraft and aircraft weapon, it is expected that this development will be superseded by a combination armor-piercing tracer bullet which will sacrifice none of its tracing characteristics, but which will penetrate at least ½-inch of armor. This is a far greater amount than any plane will carry for some time to come. In the case of the caliber .30 armor-piercing ammunition, it is very

accurate, more so than the present standard service ammunition, and can be compared to Match ammunition.

The Caliber .22 and Rifle Training

An important peace time small arms project for training purposes and for keeping alive the spirit of rifle marksmanship in connection with national defense is the manufacture of a caliber .22 rifle. This rifle is known as the U. S. Rifle, caliber .22, Model of 1922 MI, and uses the long rifle cartridge. It is as accurate as the service rifle up to a range of 200 yds., and will be used by the Regular Army for competitions and gallery practice.

Table 1

Old and New Types of Small Arms

Small Arms	Standard Types for Manufacture	Proposed New Types
Service Rifle	Rifle, U. S., Caliber .30, M1903	
Gallery Practice Rifle	Rifle, U. S., Caliber .22, M1922 MI	
Semi-Automatic Rifle	----	Rifle, Semi-Auto., Garand, Cal. .30 (being manufactured for test). Rifle, Semi-Auto., Pedersen, Cal. .276 (being manufactured for test). Rifle, Semi-Auto., Thompson, Cal. .30 (being manufactured for test).
Automatic Rifle	Rifle, Auto., Browning, Cal. .30, M1918.	
Machine Rifle (Cavalry)	Rifle, Machine, Browning, Cal. .30, M1922.	
Automatic Pistol	Pistol, Automatic, Cal. 45, M1911	Caliber .22 Attachment for Caliber .45 Pistol (under development).
Ground Type M. G., Cal. .30	Gun, Machine, Browning, Cal. .30, M1917.	
Tank Type M. G., Cal. .30	Gun, Machine, Browning Tank, Cal. .30, M1919	Gun, Machine, Browning Tank, Caliber .30, M1919 MI.
Antiaircraft M. G., Cal. 50	----	Gun, Machine, Browning Watercooled, Caliber .50, M1921 (undergoing service test).
Aircraft Type M. G., Cal. .50	Gun, Machine, Browning Aircraft, Cal. .50, M1921	Gun, Machine, Browning, Aircraft, Caliber .50, M1923 (Ordnance tested and held in reserve pending decision of Air Service concerning need for double feed Cal. .50 Gun).
Aircraft Type M. G., Cal. .30	Gun, Machine, Lewis Aircraft, Cal. .30, M1918 Gun, Machine, Browning Aircraft, Cal. .30, M1918 MI (standard for issue only)	Gun, Machine, Browning Aircraft, Caliber .30, M1919 (undergoing ser. test). Gun, Machine, U. S. Aircraft, Caliber .30, M1922 (development suspended pending decision of Air Service concerning need of double feed gun).
Proposed New Types		
Automatic 37 mm. Gun	Gun, Automatic, Browning Aircraft, 37-mm, 2000 f. s. (undergoing Ord. test)	Gun, Automatic, Aircraft, M1924-E, 37-mm., 1350 f. s. (undergoing Ord. test).
	Gun, Automatic, Browning Aircraft, 37-mm., 1350 f. s. (undergoing Ord. test)	Gun, Automatic, Aircraft, M1925-E, 37-mm., 2000 f. s. (under development).

Table 2

Data Concerning Antiaircraft Machine Guns, Caliber .30 and .50

	M1917 Browning Machine Guns, Caliber .30		M1921 Browning Machine Guns, Caliber .50
	Present Service	*New Service	
Muzzle Velocity—f. s.	2700	2700	2500
Max. horizontal range—yds.	3400	6000	9000
Max. vertical range—yds.	2600	4700	7000
Rate of fire—per min.	550	550	550
Length of daylight visibility of trace of tracer ammunition—yds.	1100	------	2200
Weight of bullet—grains	150	172	812
Muzzle striking energy—ft. lbs.	2400	2800	11300
Max. penetration in armor of A. P. ammunition—inch	.6	.6	1
Weight of gun without water—lbs.	30.5	30.5	66
Weight of gun with water—lbs.	36.5	36.5	86
Weight of tripod—lbs.	75	75	132
Weight of gun with water and tripod—lbs.	111.5	111.5	218
Max. elevation—deg.	85 - 90	85 - 90	85
Traverse—deg.	360	360	360
	° ′	° ′	° ′
Elevation for 500 yds. range	0 - 16	0 - 14	0 - 22
1000 yds. range	0 - 50	0 - 40	0 - 41
1500 yds. range	1 - 57	1 - 00	1 - 3
2000 yds. range	3 - 55	2 - 10	1 - 30
2500 yds. range	7 - 12	3 - 30	2 - 40
3000 yds. range	13 - 5	5 - 0	3 - 49
3450 yds. range	30 - 43	------	------
3500 yds. range	------	7 - 0	5 - 20
4000 yds. range	------	9 - 30	6 - 45
4500 yds. range	------	12 - 30	8 - 30
5000 yds. range	------	16 - 0	12 - 0
5500 yds. range	------	------	15 - 34
5600 yds. range	------	30 - 0	------

*The new service ammunition with the boat-tail bullet which will probably be adopted as standard for manufacture by June 30, 1925.

(Part II of this article will appear in the May-June number of Army Ordnance)

Manufacture of the Bolt of the Springfield Rifle

By

EARL McFARLAND

THE Springfield rifle, generally referred to by this name but more properly known as the United States rifle, caliber .30, model of 1903, was adopted for the United States Army as a result of a long series of tests and development work carried out at the Springfield Armory. Prior to this time the Army had been equipped with a .30 caliber rifle known as the Krag-Jorgensen. The new rifle was designed to meet improvements in the art of firearms design and manufacture, and to keep pace with the arms of other nations. The work on the Model of 1903 Rifle was so well performed that this arm still stands as the supreme military weapon of the world. Since starting its manufacture very few changes have been made, other than in the type of sight and bayonet. The operating parts of the rifle have continued with practically no change in design, but of late years the greater requirements for accuracy in target firing and training have imposed very severe restrictions on the latitude allowed in the manufacture of the piece. Each year a limited number of specially selected and targeted rifles are manufactured for use of competing rifle teams at the National Rifle Matches. The rifles selected for this purpose are especially manufactured and gaged by the inspectors in such a way as to reject for this special purpose any components which are not very close on certain specified points.

The Rifle Components

The principal parts of any rifle are accurately given in the often-used phrase, "lock, stock and barrel." In this sense, however, the lock must be interpreted to mean both the receiver and bolt. The receiver is the heart, the vital organ, of the arm around which the weapon is built. On the forward end of the receiver is attached the barrel. Within the receiver slides the bolt, which is actually the lock. Under the receiver is fitted the trigger mechanism for firing, and behind the receiver is placed the stock to permit convenient aiming.

The rifle is a unit composed of various components; each component must be so formed that it bears a correct and accurate relation to every other component. The various parts are so intimately connected that a modification in one is likely to entail a train of changes in others, even though not in immediate contact with them. These requirements have always called for very fine work in the manufacture of firearms, even before the days of interchangeability. The conception of interchangeable manufacture seems to have originated from the necessity of replacing broken and damaged parts of mutilated rifles on the battlefield. From this origin has grown up the immense field of interchangeable production now followed in all lines of manufacture, but not so much as a means for the replacement of parts as a means of mass production.

The bolt of the Springfield rifle, both as to its importance in the functioning of the arm and as to its interest in manufacture, is a good example of an article or component that presents a real problem in obtaining quantity production with great precision; and the purpose of this paper is to describe in some detail the methods used in the manufacture of this component.

The bolt carries the firing pin and extractor machanisms, and comes in contact with more components of the rifle than any other part, with the possible exception of the receiver. The smooth and easy working of the rifle depends almost entirely upon the bolt, and satisfactory operation cannot be obtained unless the bolt is accurately machined. The bolt moves backward and forward, and rotates in the well of the receiver; it carries the cartridge into the firing chamber and supports its head when fired. The sleeve screws into the rear end of the bolt. The extractor is attached to it by means of the extractor collar, and the safety lock, cut-off, cocking piece, firing-pin rod, mainspring, firing-pin sleeve, and striker are all attached to or come in contact with it. The locking lugs of the bolt when in the closed position are set firmly against corresponding locking surfaces on the receiver. On the accuracy of these surfaces depends the effectiveness of the lock, and on the tolerances given depends the all-important matter of head space. Head space, in turn, controls the satisfactory functioning of the ammunition as it measures the distance between the front supporting shoulder in the chamber and the point of rear support of the cartridge case; if this distance be too great, the brass case will be pulled apart by the action of the powder pressure and a broken cartridge case, rendering the rifle inoperative, will result.

The outline, dimensions, and tolerances of the bolt are shown in Fig. 1. Letters indicating the names of certain features are as follows:

A, Handle
BB, Locking Lugs
C, Safety Lock
D, Extractor Collar Groove
E, Extractor Cam
F, Sleeve Clearance
G, Safety-Lock Spindle Notch
H, Sleeve-Lock Notch
I, Firing-Pin Hole
J, Cocking Cam
K, Cock Notch
L, Extractor Groove
M, Rim

As the problem to be presented is one of manufacture rather than design, it will be presumed that the design as shown is standardized and satisfactory, and that tolerances can be justified; and in fact, even eliminating the question of interchangeability (which, however, is of material importance in view of the large quantity of rifles in storage), the component parts of the rifle are so connected that even a slight change in one component is almost ertain to cause difficulties and unsatisfactory performance on account of its relation with other parts.

Metal Specifications for Bolt

The steel specified for the bolt is known locally as class "C" steel and is classed as "WD 1325" in the metal speci-

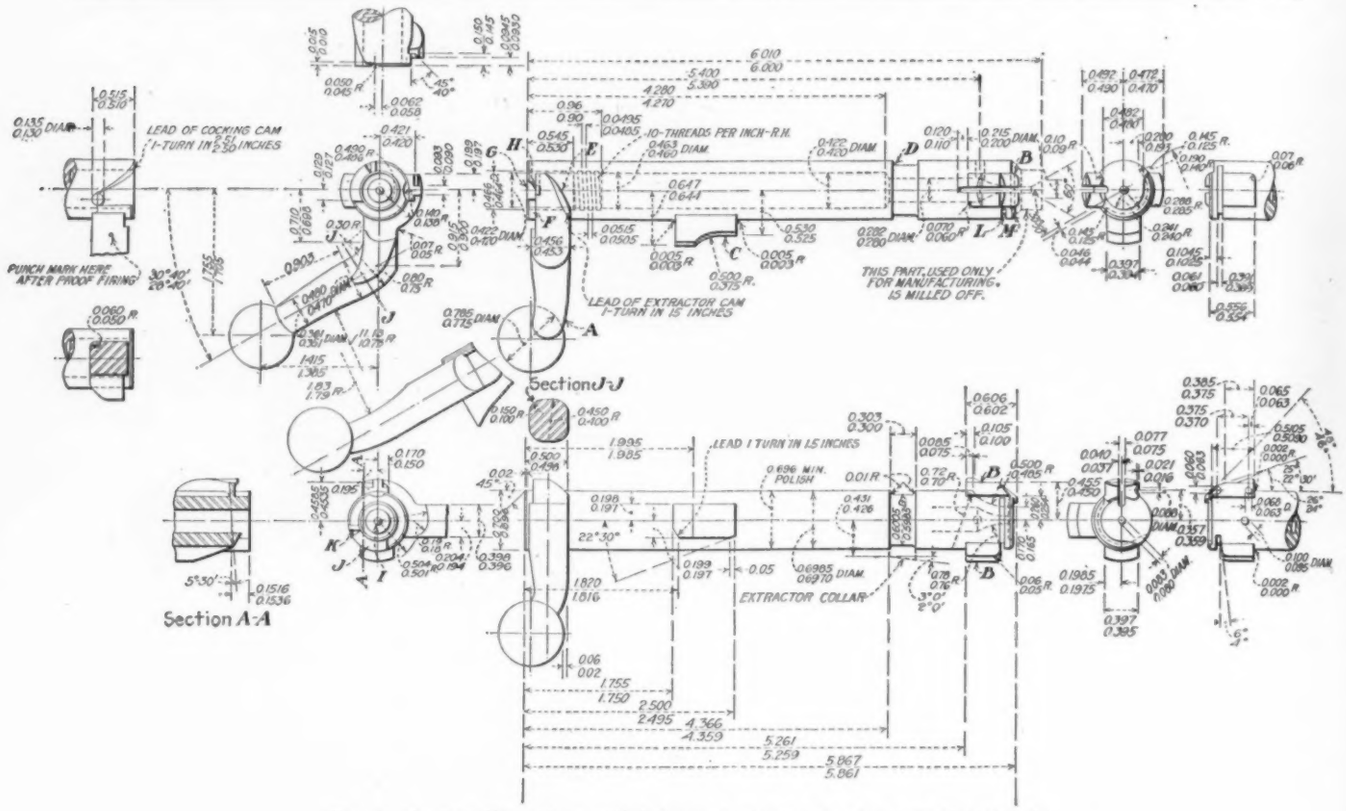

LEAD OF COCKING CAM
1-TURN IN 2.51 INCHES
PUNCH MARK HERE AFTER PROOF FIRING
10-THREADS PER INCH-R.H.
LEAD OF EXTRACTOR CAM
1-TURN IN 15 INCHES
THIS PART USED ONLY FOR MANUFACTURING. IS MILLED OFF.
Section J-J
Section A-A
LEAD 1 TURN IN 15 INCHES
EXTRACTOR COLLAR

Fig. 1. Outline, Dimensions, and Tolerances of the Bolt of the Springfield Rifle

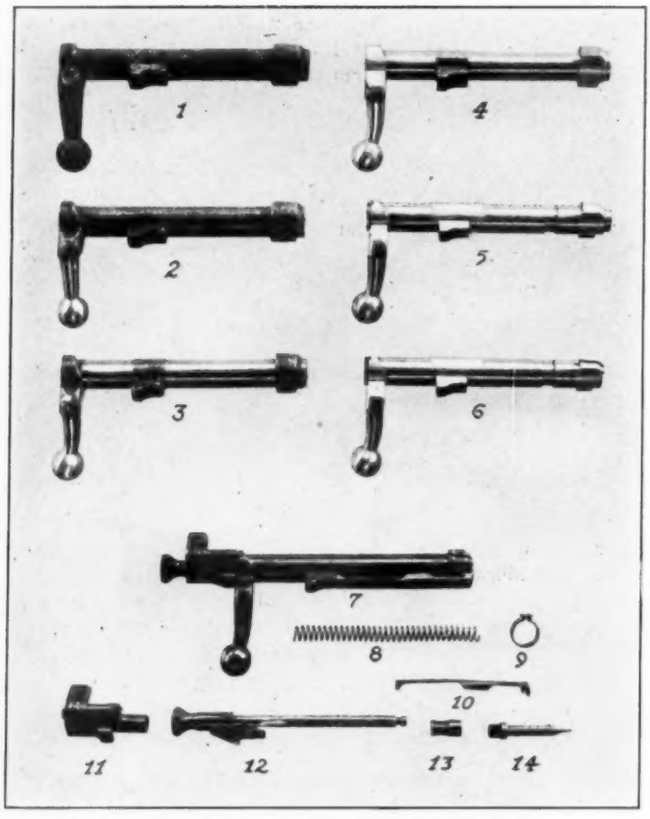


Fig. 2. Development and Assembly of Bolt

(1, Forging; 2, Handle milled, rear face finished, inside holes drilled; 3, Bolt body turned; 4, Locking lugs, extractor cam; top and bottom of handle milled; 5, Safety lock, extractor collar groove, sleeve-lock notch finished; 6, Bolt complete, cocking cam, ejector slot, and front-end operations finished; 7, Assembled bolt; 8, Mainspring; 9, Extractor collar; 10, Extractor; 11, Sleeve, with safety lock assembled; 12, Firing pin and cocking piece; 13, Firing-pin sleeve; 14, Striker.)

fications of the Ordnance Department of the Army. The chemical analysis is:

Carbon	0.20 to 0.30
Manganese	1.00 to 1.30
Silicon	0.15 to 0.35
Sulphur and phosphorus, minimum	0.050

After all machining operations are completed the bolts are sent to the case-hardening department where they are heat-treated in the revolving carburizing machines No. 2, as manufactured by the American Gas Furnace Company.

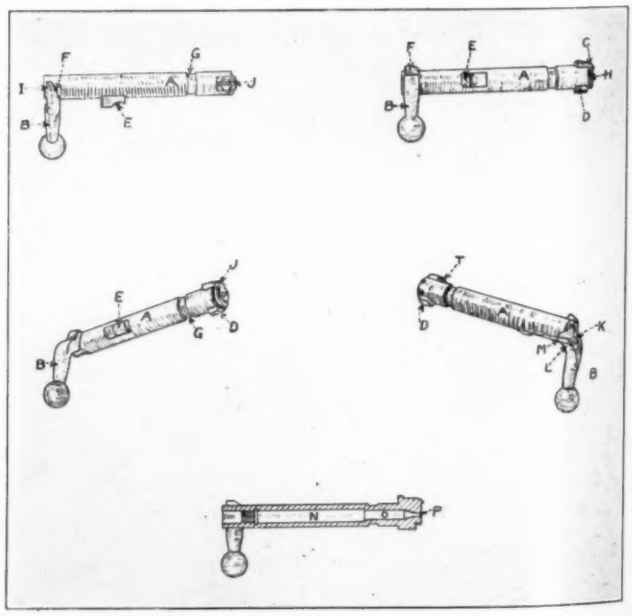


Fig. 3. Main Operations on Bolt

A, Body; *B*, Handle; *C*, Upper locking lug; *D*, Lower locking lug; *E*, Safety lug; *F*, Extractor cam; *G*, Extractor collar groove; *H*, Extractor groove; *I*, Sleeve-lock notch; *J*, Ejector groove; *K*, Sleeve stop; *L*, Under side of handle; *M*, Cocking cam; *N*, Firing-pin hole; *O*, Striker hole; *P*, Striker-point hole.

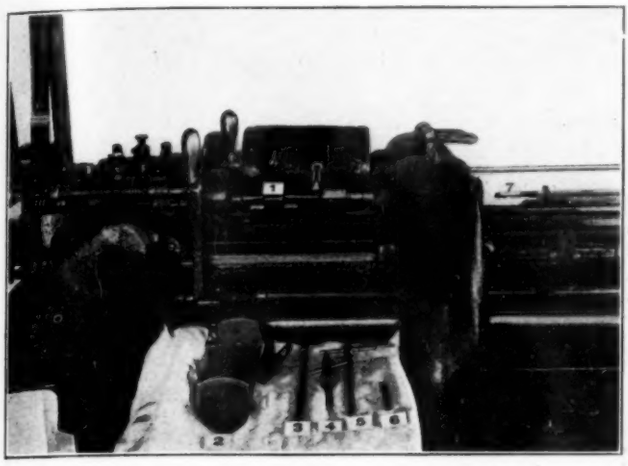


Fig. 4. Operation 2—Drilling the Firing Pin Hole

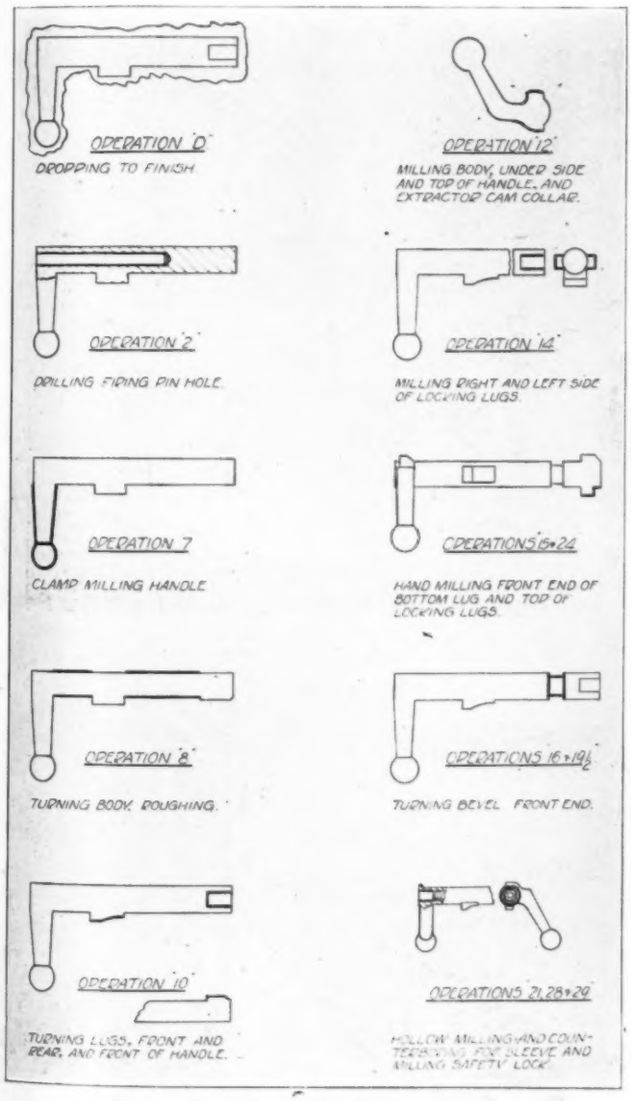

OPERATION 'D'
DROPPING TO FINISH.
OPERATION '12'
MILLING BODY, UNDER SIDE AND TOP OF HANDLE, AND EXTRACTOR CAM COLLAR.
OPERATION '2'
DRILLING FIRING PIN HOLE.
OPERATION '14'
MILLING RIGHT AND LEFT SIDE OF LOCKING LUGS.
OPERATION '7'
CLAMP MILLING HANDLE.
OPERATIONS '15 & 24'
HAND MILLING FRONT END OF BOTTOM LUG AND TOP OF LOCKING LUGS.
OPERATION '8'
TURNING BODY, ROUGHING.
OPERATIONS '16 & 19½'
TURNING BEVEL FRONT END.
OPERATION '10'
TURNING LUGS, FRONT AND REAR, AND FRONT OF HANDLE.
OPERATIONS '21, 28 & 29'

Fig. 5. Some of the Operations on the Bolt
(Heavy lines show the metal removed during the operation)

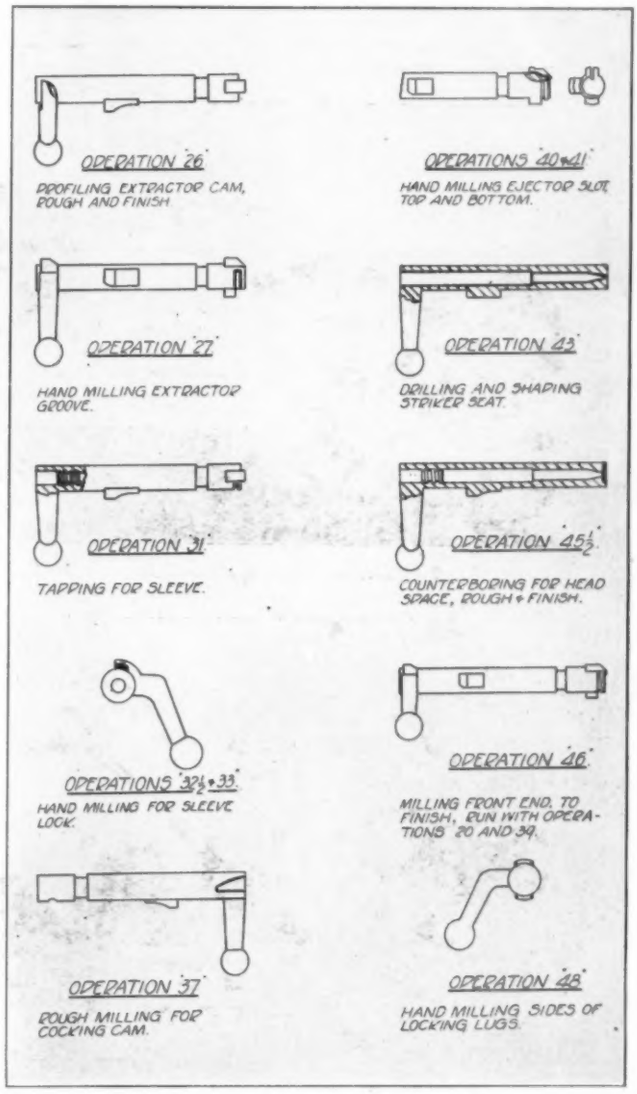

OPERATION '26'
PROFILING EXTRACTOR CAM, ROUGH AND FINISH.
OPERATIONS '40 & 41'
HAND MILLING EJECTOR SLOT, TOP AND BOTTOM.
OPERATION '27'
HAND MILLING EXTRACTOR GROOVE.
OPERATION '43'
DRILLING AND SHAPING STRIKER SEAT.
OPERATION '31'
TAPPING FOR SLEEVE.
OPERATION '45½'
COUNTERBORING FOR HEAD SPACE, ROUGH & FINISH.
OPERATIONS '32½ & 33'
HAND MILLING FOR SLEEVE LOCK.
OPERATION '46'
MILLING FRONT END, TO FINISH, RUN WITH OPERATIONS '20 AND 39.
OPERATION '37'
ROUGH MILLING FOR COCKING CAM.
OPERATION '48'
HAND MILLING SIDES OF LOCKING LUGS.

Fig. 6. Further Operations on the Bolt
(Heavy lines show the metal removed during the operation)

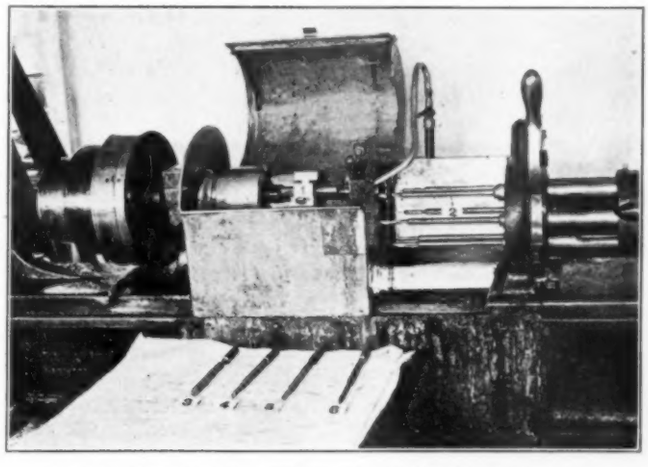


Fig. 7. Operation 43—Drilling and Shaping the Striker Seat

With the furnace at 1500 deg. F. approximately 200 bolts are charged into the furnace by means of special shovels. Charred animal bone is used for carbonizing, 80 lbs. being used for each heat. Of the 80 lbs. used, 40 lbs.

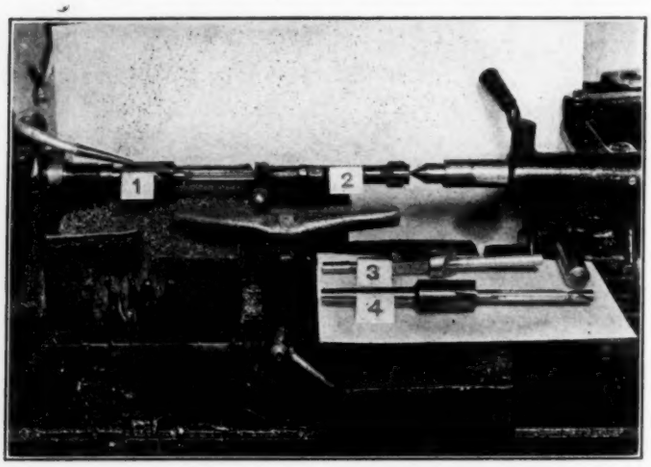


Fig. 8. Operation 6—Facing the Rear End of Bolt

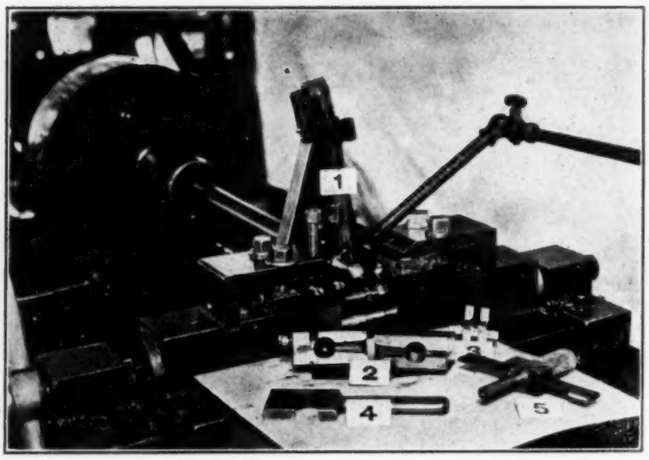


Fig. 9. Operation 7—Clamp Milling the Handle

are old bone (used once) and 40 lbs. fresh bone. After charging, the door of the furnace is put in place and is screwed tight. By means of an electric motor the muffle revolves once per minute. The furnace is kept at 1500 deg. F. for 2¾ hrs. At the end of this time the work is removed and quenched in an oil tank. The work remains in the oil until cold.

The bolts are then taken to the salt bath, heated to 1310 deg. F. for 5 min. and then again quenched in oil. After washing the bolts in water to remove all traces of salt, they are tempered in oil at 350 deg. F. for 15 min. After removing from the tempering bath, the bolts are washed in boiling soda water and are then ready for inspection.

The original hardening is for the purpose of giving a hard exterior surface to the bolt. However, in accomplishing this the interior of the bolt is likewise made hard and brittle. The subsequent heat treatment is for the purpose of reducing the hardness and brittleness of the interior, and producing in its place a core of tough, ductile steel.

How the Bolt is Manufactured

The manufacture of the bolt from forging to finished component is accomplished almost exclusively by special tools, cutters, jigs, fixtures, and gages. Many standard machine tools are used in the process but a few have been specially built from the ground up for their particular purposes. In outline, the sequence of major machining and gaging operations is as follows:

a, Cut to length, Operation 1;
b. Drilling and shaping hole, Operations 2, 3½, 43 and 43½;
c, Centering front end for working, Operation 5;
d, Facing rear end (finish), Operation 6;
e, Turning body of barrel, Operations 8 and 9;
f, Turning front lugs and safety lock, and front of handle, Operations 10 and 11½;

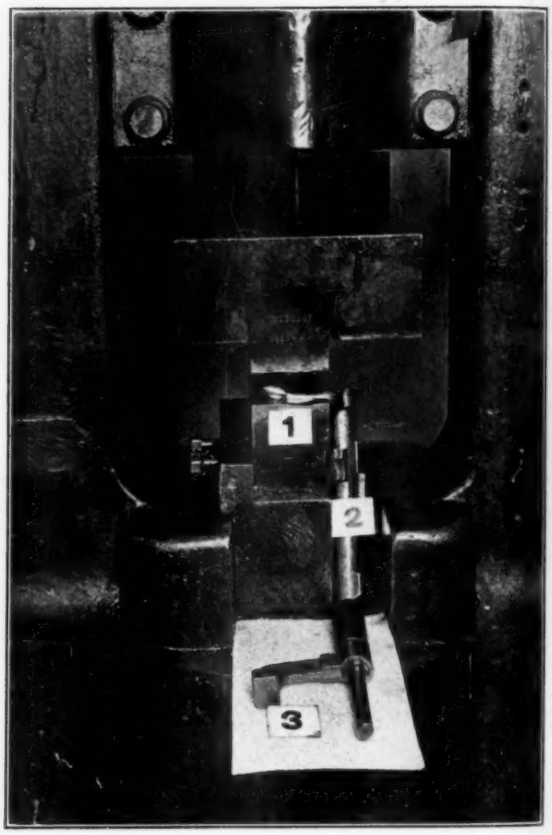


Fig. 10. Operation 58—Boring the Handle in Hoe Press Production, 120 per Hour

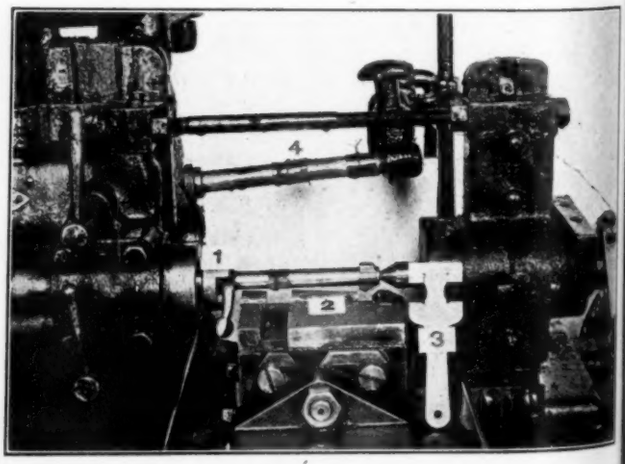


Fig. 11. Operation 9—Turning Body to Finish—A "Skiving" Operation

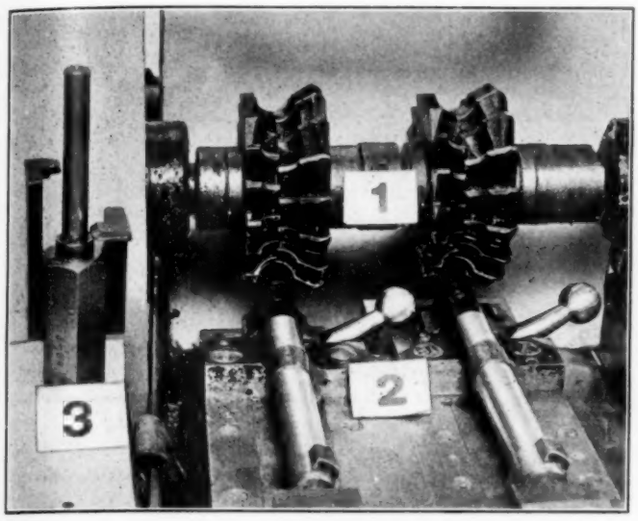


Fig. 12. Operation 12—Milling Body and Underside of Handle

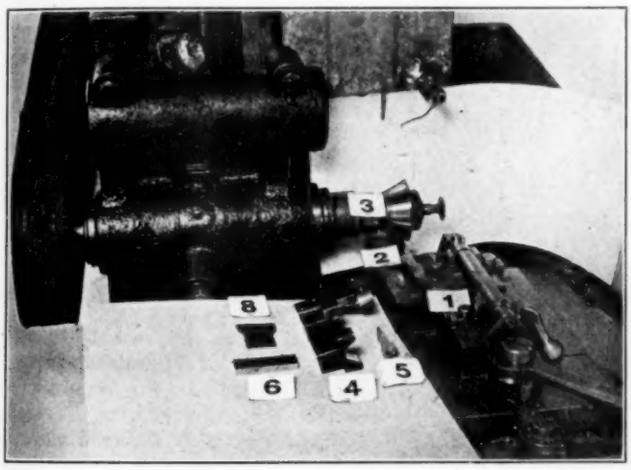


Fig. 13. Operation 41—Hand Milling Ejector Slot Through Upper Locking Lug

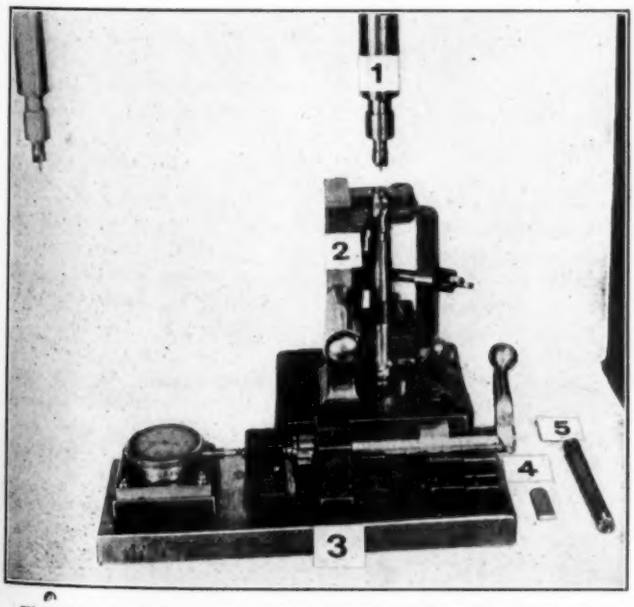


Fig. 14. Operation 45½—Counterboring for Head Space, One of the Very Accurate Operations

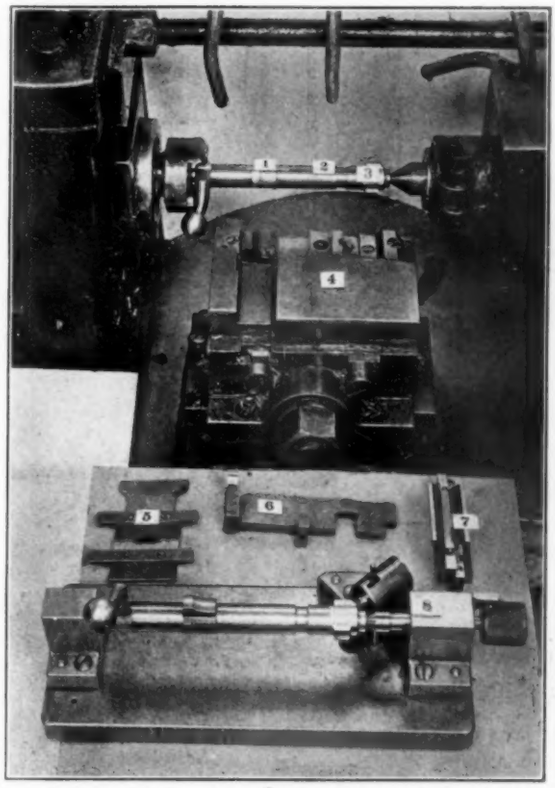


Fig. 15. Operation 16-19½—Turning Bevel Front End, Extractor Collar Groove, and Top of Safety Lug

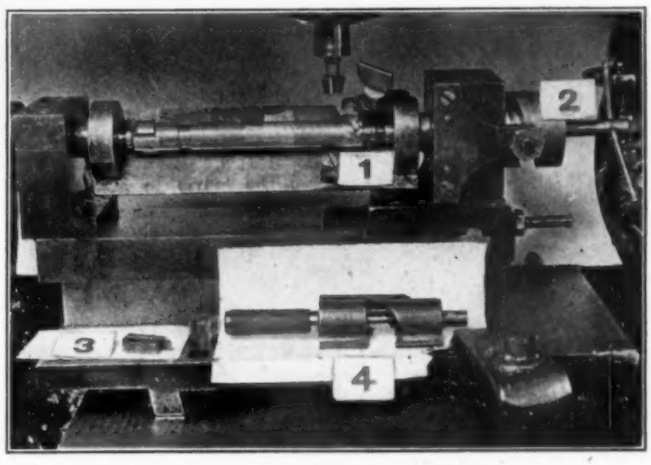


Fig. 16. Operation 26—Profiling the Extractor Cam

g, Milling bottom and top of handle and around barrel Operation 12;

h, Milling front end and under side of bottom locking lug, Operations 15 and 24;

i, Milling (finish) for width of locking lugs, Operation 48;

j, Milling and counterboring for sleeve and safety lock, Operations 21, 28 and 29;

k, Profiling cams, Operations 26 and 38;

l, Milling for sleeve lock, Operations 32½ and 35;

m, Tapping for sleeve, Operation 31;

n, Bevel top of upper locking lug, Operation 44;

o, Mill ejector slot, Operations 40 and 41;

p, Turning rear of locking lugs to gage, Operation 44½;
q, Milling extractor groove, Operation 27;
r, Counterboring for head space, Operation 45½;
s, Filing and general cornering, Operation 64.

Each of the above operations is important and necessary in the proper functioning of the rifle except operations

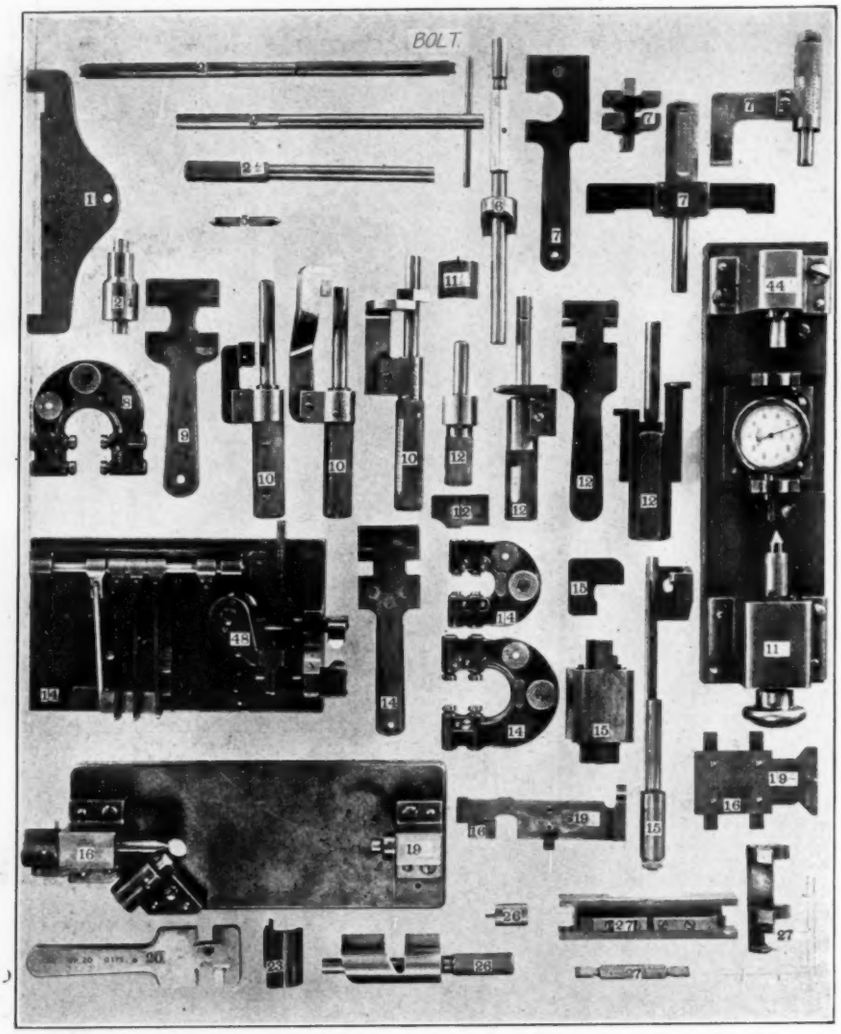


Fig. 17. The Gages Used in the Manufacture of the Bolt of the Springfield Rifle

(*a*), (*c*), and (*d*), which are used for working and gaging purposes only.

The primary gaging operations are:

a, Length;
b, Diameter and location of bore;
c, Bore and underside of handle;
d, Rear face of bolt.

All of the other cuts, important in themselves, are dependent on one or more of the four points above for their location and gage dimensions.

There are described in the following paragraphs a few examples of some of the operations listed above. An effort has been made to show methods which are particularly adapted to gun manufacture, but which at the same time may find some application in other lines of production.

Drilling the Firing-Pin Hole (Operation 2).—This operation consists in drilling the main part of the firing-pin hole as shown in Fig. 5 and is performed on a Pratt & Whitney two-spindle barrel-drilling machine of the same type as those used in drilling rifle barrels at the Armory. The work is held in clamped fixture which rotates on its own bearings, and is located by means of four screws in the base of the fixture. When a lot of forgings varies from the preceding lot, these screws are changed accordingly. The drill itself is of the single-lip type, similar to the barrel drill, the drill point being brazed to a hollow rod. The combination drill and rod is fluted on the outside and has a hole 0.05 in. in diameter, into which lard oil as a cooling medium is forced at 700 lb. pressure. The chips are forced backward along the fluting.

The set up, fixture gages, and drill point are shown in Fig. 4.

Six machines are run by each operator, eight pieces are produced per machine per hour, and the material is given a 100 per cent inspection. A diameter tolerance of only 0.002 in. is allowed. The bore is held close as it is used as a holding and location point in many operations that follow.

Drilling and Shaping the Striker Seat (Operation 43).—Immediately preceding this operation, the firing-pin hole and the striker hole are rough drilled, allowing the tools for operation 43 to pass through the rear of the bolt. The machine used is a Pratt & Whitney 16-in. hand-screw machine, the work being clamped in a revolving cradle fixture. Six tools are held in the turret. The order of cuts is as follows:

1 Finish drilling firing-pin hole
2 Reaming to square the end of firing-pin hole
3 Spotting striker-point hole
4 Drilling striker-point hole
5 Roughing striker seat
6 Forming striker seat.

As can be observed from the set-up shown in Fig. 7, all the tools are guided by pilots to align as nearly as possbily the centre lines of the successive holes. The tools, excepting the two small spotting drills, are pinned into the pilots or arbors and float slightly. The drills are held on small chucks which screw into the pilots. Chip clearance is provided.

Depth gaging is necessary to insure that just enough stock is left for subsequent finishing operation, as an excess of stock would greatly increase the hand labor required. Only a small percentage of the output is gaged at this point.

An operator can perform work on only one machine and produces 40 pieces per hour. The tolerances allowed on both depth and location are 0.01 in.

Facing Rear End and Reaming Firing-Pin Hole in Lathe (Operation 6).—This is the first reaming operation on the

firing-pin hole (to 0.420 in.) and faces the rear end of the bolt, a primary gaging surface from which most of the longitudinal dimensions are taken. The front end of the bolt has been previously countersunk for the lathe center (Operation 5). Fig. 8 shows the manner of placing the bolt in the lathe, the combination reamer and facing tool used, and the gage.

One hundred and fifty pieces are produced per hour per machine from one operator. The cut is given a 100 per cent inspection and the diameter tolerance allowed is 0.002 in. As with Operation 2 mentioned above a close tolerance is held, for if this hole be not of the proper size and in proper location, many other cuts will not be true.

Clamp Milling the Handle (Operation 7).—Fig. 9 shows an interesting operation on milling the handle and ball of the bolt. The machine used is one especially built at the Springfield Armory for this work and has been in use since the beginning of the manufacture of the Model of 1903 rifles. The bolt is held in a driving fixture so that the center line of the handle will be perpendicular to the hole in the bolt. Clutch control is provided. One cut is made with the cutters which are hand fed onto the work by means of right- and left-hand screws. The forms of the cutters and gages are shown in the figure. An operator produces 65 pieces per hour. The average life of tools between grindings is 1000 pieces. A small percentage of the bolts is inspected at this operation and the tolerances allowed are 0.01 in. for the diameter of the handle and ball, and 0.015 in. for location.

Bending the Handle (Operation 58).—The slight offset given to the handle after the milling operation just described is necessary in order that the ball may clear the fixtures used in succeeding turning operations. This slight bend has been introduced within the past few years and is not to be found in the earlier rifles produced. A Hoe hand screw press is used, according to the set-up shown in Fig. 10. The production is 120 per hour, the inspection is very limited, and the tolerances reasonably great.

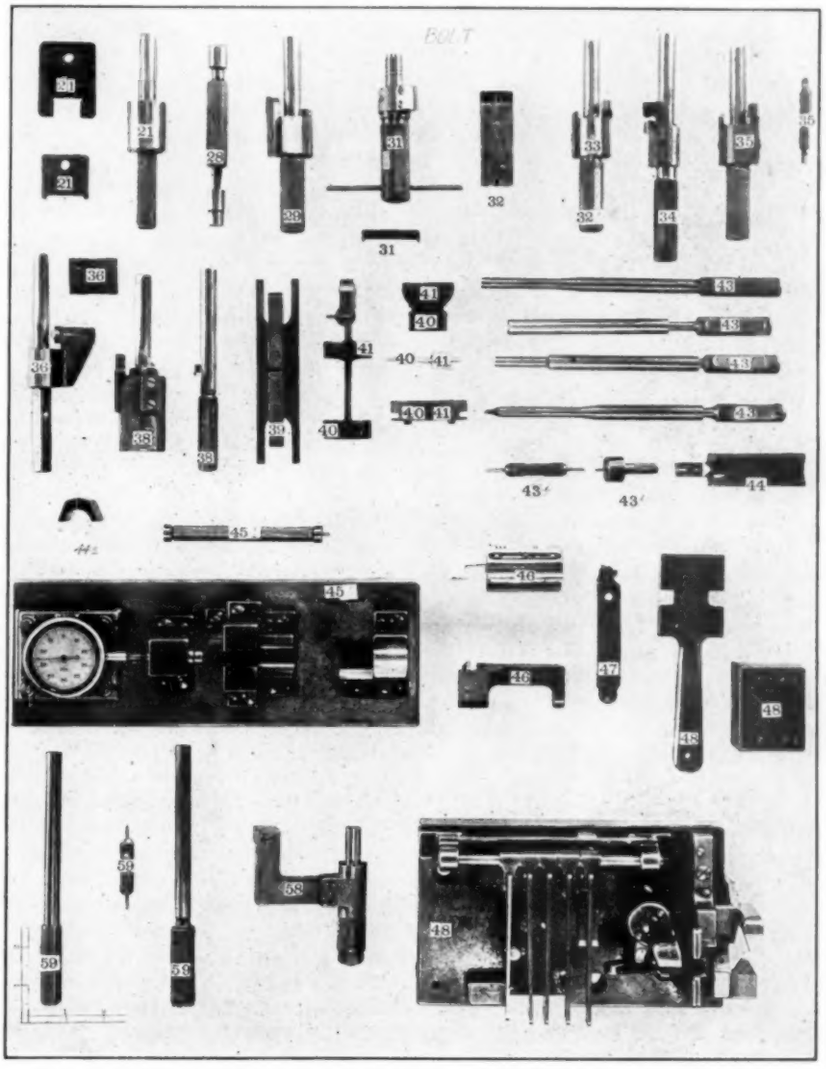


Fig. 18. The Gages Used in the Manufacture of the Bolt of the Springfield Rifle

Turning Body to Finish (Operation 9).—This type of turning is performed on a Pratt & Whitney automatic milling machine, and uses a flat forming tool and shearing undercut. It is actually a skiving operation and was introduced in the manufacture of the bolt about twenty years ago in preference to the usual turning methods, as it is peculiarly adapted to this component whose lugs and handle interfere with ordinary lathe methods. The cutter is made in sections to allow the lugs to pass through it. It is a comparatively simple tool to form and is economical in manufacture. Fig. 11 shows the bolt held on centers and being driven by special driving center and holder. Oil lubrication is used, the large oil pipe permitting the work to be flooded. Two skiving cuts are used, a roughing cut of about 0.040 in. and a finishing cut of about 0.015 in., which leaves a bright, smooth surface.

"Go" and "no go" snap gages are used and a 0.0015-in. tolerance only is allowed. The accuracy is consistently maintained and without great difficulty. A close tolerance is required and every piece is inspected as this is one of the few moving surfaces of the rifle, and the bolt diameter directly affects the bolt fit in the well of the receiver. Any undue looseness at this point causes a variation in weight of trigger pull and in safety of trigger mechanism. Each operator is responsible for six machines and produces 25 pieces per hour per machine. The average life of tools between grindings is upward of 5000 pieces.

Milling Underside of Handle and Right Side of Bolt Body (Operation 12).—This operation, illustrated in Fig. 12, shows the general method employed for several of the milling cuts on the bolt. The automatic type of miller is used. A special fixture is employed holding two bolts supported on centers by V-blocks clamped by cams on the bolt ends. A similar machine equipped in like manner mills the top side of the bolt and the upper surface of the extractor cam.

The underside of the bolt handle, determined in this

operation, is extensively used as a bedding point in both the operations of manufacture and gaging. It will be observed that most of the gages which locate lugs and surfaces have a bearing point on this shoulder, which also determines the bolt location in various fixtures.

Each operator runs six machines, produces 25 pieces per hour from each, and gets an average life of tool between grindings of 2000 pieces. A 100 per cent inspection is accomplished and the tolerance is held to 0.002 in.

Hand Milling the Ejector Slot (Operation 41).—Cutting the slot in the top lug in order to permit the proper functioning of the ejector is a small operation requiring refined practice. The ejector works through the slot to throw the fired cartridge case out of the rifle, and the slightest interference would cause malfunctioning and would burr the ejector. The set-up is shown in Fig. 13. A hand miller with form and roller is used. The form and the saw milling cutter produce the right contour of slot. Formerly two separate operations, a top and a bottom cut, were required. A cam fixture holds the work, the underside of the handle determining the bolt's location in the fixture. The cut is gaged for depth, for width, for location from side of lug, and for depth and location of radius on bottom of slot.

An operator handles one machine, with a production of 165 pieces per hour. Each piece is inspected and the tolerances permitted are 0.002 in. for width of slot, 0.010 in. for location, and 0.005 in. for depth.

Counterboring Forward End of Bolt for Distance or "Head Space" (Operation 45½).—Fig. 14 shows the somewhat complicated fixture and the gages used in performing this operation. The rear face of the locking lugs has been previously turned with great accuracy, measurement being made from the rear face of the bolt. In Operation 45½ the measurement is made from the rear face of these lugs to the counterbored surface. The head-space adjustments are dependent upon the surfaces just mentioned and are of primary importance in determining the safety of the weapon and the proper functioning of the ammunition.

Formerly two operations were provided, roughing on a spindle drill and finishing in a hand fixture. They are now performed as one operation on an Allen two-spindle drill press which gives the required finish and accuracy on the second cut. The work is clamped by an equalizing bar in the drill jig, and bedded on the rear face of the locking lugs. Three gages are used: these are the indicating dial gage, checking the distance from the rear of the locking lugs to the counterbored surface (or cartridge seat); a plug gage for the diameter of the counterbored surface and its location from the firing-pin hole; and a straight edge for the cartridge seat.

Forty-five pieces are produced per machine per hour by one operator. The life of the tool between dressings is 500 pieces. A careful inspection of every piece is required and a tolerance of 0.0015 in. is rigidly maintained.

Turning the Bevel at the Front End of the Bolt, the Extractor Collar Groove, and the Safety Lug (Operation 16-19½).—The set-up and operation, shown in Fig. 15, are somewhat similar to the skiving operation referred to as Operation 9. The gages used are shown in the figure. The tolerances allowed are fairly liberal with the exception of the diameter of the extractor collar groove which is held to 0.002 in. so that the functioning of the extractor may be certain. The average life of the tool between grindings is 1500 pieces.

Profiling the Extractor Cam (Operation 26).—Fig. 16 illustrates the method of profiling the extractor cam, and a similar process is followed in producing the cocking cam on the underside of the bolt. This cam gives primary extraction to the cartridge case and is an important factor in the smoothness and ease of operation of the bolt in the receiver. A Reed-Prentice profiler is used. The bolt is held clamped on centers on a rotating fixture, the bedding point being the shoulder on the underside of the bolt handle. The guide cam shown at the right of the fixture produces the desired profile. Two cuts are made, one roughing, and a finishing cut of about 0.015 in. An operator handles one machine and produces 65 pieces per hour. The life of the cutter between grindings is 2500 pieces. A rigid inspection is maintained and a longitudinal tolerance in the location of the cam of 0.002 in. is allowed.

How the Rifle is Gaged

The system of gaging used in the manufacture of the Springfield rifle is the outgrowth of the gage methods used for its predecessor, the Krag-Jorgensen rifle. The Krag gages were in turn developed from the older 1873 and 1884 models of the Springfield rifle, although these earlier rifles were of very different operation and type. In many cases old gages, in the interest of economy, were used by the necessary modification for the newer models of rifles, and the system of gages thus built up represented merely an evolution rather than a complete and systematic set of gages designed in accordance with the proper technical and engineering viewpoint. It can be said that the first set of gages used in the manufacture of the Springfield rifle allowed no tolerances whatever, all of the gages having been manufactured in accordance with a flat dimension. It is obvious, and was obvious, that it is impossible to manufacture on a production basis without some allowance or leeway in dimension on account of inaccuracies in the machine, the tools, and the hand of the operator. With the earliest system of gages in vogue it is, therefore, apparent that the inspector actually carried the tolerances "under his hat." In other words, the inspectors had been in the employment of the Springfield Armory and had been doing this particular kind of work for such a long period of years that they knew from the amount of light showing between the gage and the work whether or not the work would be satisfactory for the purpose for which it was required. The satisfactory operation of a system of this character is based entirely upon the knowledge of the inspectors and not upon the sufficiency of the gages. Such a condition is incompatible with mass production or with changing personnel.

Shortly after the outbreak of the World War in 1914, large orders for munitions were given to manufacturers of this country and the production of war supplies was, for a time, the most important product of our metal-working plants. Production in quantity was the key-word, and it became more and more evident as the weeks went by that production in quantity meant interchangeable manufacture, which in turned depended finally upon proper gaging methods as a means of determining the degree of satisfactoriness of interchangeability. This condition brought more forcibly to the attention of the authorities at Springfield Armory the fact, already well known to them, that the system of gaging employed at their establishment required revamping in order to be at all satisfactory

for use by outside concerns, should it ever be desired to give orders for the Springfield rifle to commercial plants, and for high production of rifles at the Amory under the enlarged program requiring additional operators, additional inspectors, and a large turnover of labor. Steps were accordingly taken to provide new gages which would embody the latest principles of gage engineering and would place the gaging system upon a modern and scientific basis. After long study and investigation a new set of master, inspection, and working gages was designed and master reference gages were produced.

If the benefits of the new study of gages were to be immediately realized by the Springfield Armory it would require that the system of gages that had long been in use be immediately discontinued and that new gages built in accordance with the new drawings be substituted therefor. The expense involved in such a scheme would be very great. It was accordingly decided that the old gages would be continued on the job, but that individual gages of the old type would be replaced by gages of the new type as soon as such old gages showed wear or deterioration. The practical result is that there are now in the shops at Springfield gages of both the old and the new design, and the figures showing gages of the bolt include the old as well as those of the newer school.

The Problem Facing American Engineers in Rifle Manufacture

The manufacture of the bolt of the rifle as its production is followed at the Springfield Armory gives an example of the highly specialized use of tools, jigs, fixtures, and gages which is typical of the gun-making industry. All of the information transmitted to the operating personnel is that conveyed by means of the appliances and fixed gages, specially designed and built for each operation. This equipment, as it is, has been found necessary and has been produced to meet the requirements of today's mechanics and operators. Like conditions prevail in practically all plants manufacturing small-arms weapons in this country. The operators available for high-class work appear to be diminishing in number and in skill. To maintain supremacy, the American engineer will in the future be required to design even better, to plan even more skilfully, and to produce even more scientifically the material, fixtures, and gages that will insure proper functioning of the article under manufacture—made, however, by the hand of an operator whose skill is diminishing year by year.

(Reprinted from Mechanical Engineering, August, 1924, Cuts by courtesy of Editors, Mechanical Engineering.)

Extensive Salvage Operations of Ordnance Department at Fort Sill

THE Field Artillery School is considered the greatest artillery center in the United States Army. There are fired on the Fort Sill Reservation probably more rounds of artillery ammunition than on any other firing center in the world. It is the desire of the War Department to make the course of study at the Field Artillery School as practical as possible, and for that reason the students are given a liberal allowance of ammunition in the use of which they are taught the fundamental principles of firing. The American Army is also very fortunate in having at its disposal a great supply of war ammunition which must either be fired or allowed to deteriorate. These are the factors that contribute toward making this center of artillery training the greatest firing area in the world.

In firing the guns there are certain well-known problems of matériel, gunnery and transportation, but there is still another consideration without which the firing is impossible, and that is the phase of ammunition activity. This includes the handling and storing of projectiles, the procurement and distribution of supply, and the consideration of its transportation to and from the firing points. There is in addition still another phase of this activity with which the Ordnance of the Field Artillery School has to deal, which is of tremendous importance to the local reservation, and that is the problem of salvage.

The following table, which gives the amounts of artillery ammunition fired during the year 1923-1924, is indicative of the magnitude of the problem of caring for, storing, transporting, and salvaging this supply.

Caliber	No. of Shell	No. of Shrap.
37-mm.	4615	
75-mm.	10445	63977
3-inch	24118	23954
4.7-inch.	780	125
155-mm.	1518	1589
9.2-inch.	84	
155-mm. G. P. F.	36	

While the average field artilleryman has some conception of the tremendous tonnage involved in the above table, the following table of weights of projectiles sheds even further light on the magnitude of the problem.

Caliber	Wt. of Shell (approximate) lbs.	Wt. of Shrap. (approximate) lbs.
37-mm.	1	
75-mm.	12	16
3-inch	15	15
4.7-inch.	45	60
155-mm.	103	105
9.2-inch.	286	
155-mm. G. P. F.	120	

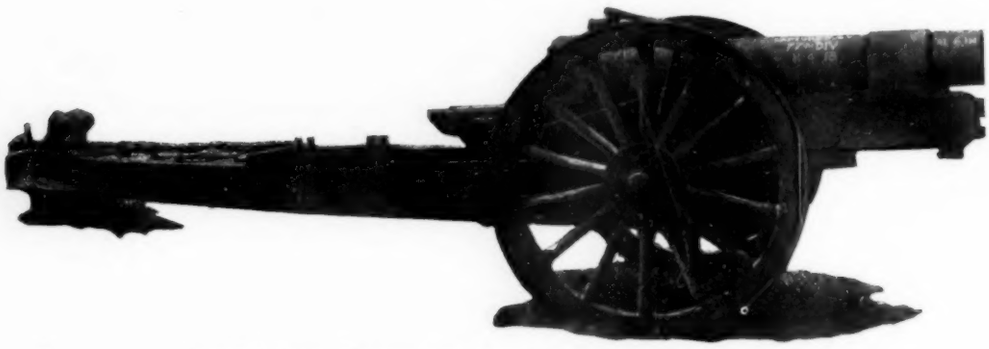
Considering the above figures it will be noted that approximately 2,376,810 pounds, or 1188.4 tons, of ammunition were fired on the Fort Sill Reservation during the academic year of 1923-1924.

The problem of salvaging on this reservation is more difficult than on any other in the army. The Ordnance Department is charged with the responsibility of salvaging as much of this ammunition as possible after it has been fired. There are several considerations in this activity; in the first place there is some monetary value to the metals of the projectiles which are scattered over the reservation. The lead, the steel, the copper, and other metals found in the ordinary round of ammunition, all have some monetary value in salvage.

A second and probably more important consideration on this reservation, is the removal of those projectiles which have failed to explode, which are commonly known as "duds." This is necessary to give the troops sufficient room to maneuver during the problems without endangering the lives of either men or animals.

There are several reasons for the failure of projectiles to explode. One reason may be that the impact of the projectile with the ground was made at too oblique an angle. Occasionally it has been found that the manufacture of the projectile has been faulty. Another contributing factor has been the deterioration of the components of the ammunition in storage. Still another cause for failure to explode is that the fuzes become unscrewed in flight.—*The Guidon, February 21, 1925.*

The Military Medal of the Army Ordnance Association



Captured 6-Inch Howitzer from which A. O. A. Decoration was Cast

THE colored frontispiece in this issue of ARMY ORDNANCE is a reproduction of the new military decoration of the Association recently adopted and cast, pursuant to a resolution of the Board of Directors. A Committee on Decorations, composed of Col. Chas. Elliot Warren, Chairman; Col. James L. Walsh; and Lt. Col. C. C. Goodrich, after an exhaustive investigation, selected the design and arranged for its manufacture.

The metal from which the decoration is cast adds considerably to the value and association of this new insignia. The bronze is taken from a captured German cannon which, as nearly as can be ascertained, has the following history: The weapon was a 6-inch Howitzer of British manufacture marked " W. B. & Co. No. 9376." All scales and direction plates were removed and replaced with German identification marks. The matériel was captured from the Germans on the 4th of November, 1918, by the 77th Division during the fighting in the Argonne Forest. It appears that the piece was on the Russian front at the time of the breakdwon of the Russian Empire and was taken over by the Germans, together with other British matériel. The piece evidently saw a great deal of action, as the bore is well worn.

The decoration itself is of size and quality similar to the Victory Medal. The insignia and detail stand out in bold relief. It is suspended from a hidden pin by a ribbon of heavy silk in the colors of the Association, crimson and yellow piped in black.

The Committee also adopted a miniature decoration similar in all details except size to the decoration itself. The miniature is adapted for wear with civilian evening dress and on other occasions. It is about two-thirds as large as the decoration proper.

The various insigniæ are sold to members of the Association only and may be procured upon application to the Secretary. The medal is sold at $1.00, the miniature at 75 cents. The other insigniæ adopted and used by the Association include the service ribbon for use on the uniform, at 25 cents each, and the civilian insignia at 50 cents. These also may be purchased through the Secretary.

The use of the military decoration by those for whom it is authorized as well as the wearing of the civilian insignia is recommended to all members as an effective way of enhancing the interests of the Association and assisting in the work of industrial preparedness.

Marks on the Captured Gun

Breech Marking

B.L. 6" 26 Cwt. How—Wire Mark I
W. B. & Co. No. 1635-17

Muzzle Marking

W. B. & Co. Steel 9396 (crown) Mark I

Painted on Side of Cradle

Ersalzbrom--EssigKeil

Painted on Side of Trail

Engl. F.H. No. 33

Painted on Gun

Captured by 77th Div.
11-4-18

Annual Report of the Chief of Ordnance

Part II

By

MAJ. GEN. C. C. WILLIAMS
Chief of Ordnance

(*Continued from* ARMY ORDNANCE *No. 28*)

INCIDENT to the development of fire-control instruments for antiaircraft matériel, the Ordnance Department purchased abroad a number of instruments, chief among which are a Barr & Stroud antiaircraft finder, a Vickers antiaircraft fire-control gear, and a French stereoscopic range finder. These will be tested by the Coast Artillery Board. Other instruments procured by the Ordnance Department and tested by the Coast Artillery are:

4-meter Goerz stereoscopic range finder.
4-meter Goerz coincidence range finder.
2-meter Reiss stereoscopic range finder.
2-meter Reiss coincidence range finder.
2-meter Barr & Stroud coincidence range finder.

The recommendation of the Coast Artillery Board relative to the test of these instruments is that none of them be adopted for the service.

The following is a list of the principal fire-control projects in progress during the year:

Development of a long-range deflection board.
Development of a long-range correction board.
Development of a suitable long-base internal range finder.
Development of an automatic fire-control system for seacoast artillery.
Development of antiaircraft fire-control apparatus.
Development of antiaircraft observation telescope.
Development of sound locating apparatus.

Gun Pointer Shield. Reports from the using services show that the effects on the gun pointer of the blast of the 12-inch gun on barbette carriage, model of 1917, are very disturbing. A shield to protect the gun pointer has been designed and manufactured at the Watertown Arsenal, and applied to one of the guns in service. The tests thus far made by the Coast Artillery indicate that the effects of the gun blast on the gun pointer are very materially reduced by this shield. Further tests will be made, and recommendations submitted relative to its adoption.

Photographic Chronograph. With a view to developing a photographic chronograph for field use, a project initiated in 1921, two instruments, one called a "Balistograph" and the other a "Micro-Chronograph," both of foreign manufacture, were purchased, and have been under test at the Aberdeen Proving Ground. The two instruments form a unit for photographing projectiles in flight, and for furnishing the means of measuring the muzzle velocity, technical velocity, etc., of projectiles. Some records have been obtained with these instruments during the three months they have been under test, but as yet the results are not conclusive; the tests will be continued.

Tanks. The design of a 15-ton tank, model of 1924, was carried to a point where manufacture was about to be inaugurated, when the Infantry entered objections to the design as not fulfilling the requirements for a medium size tank. The design had been prepared in an effort to meet the established weight limit of 15 tons, and while, as prepared, the tank could have been completed at this weight, the design did not fulfill all the requirements of the using service. Pending decision by higher authority looking to the removal of the weight limitation of 15 tons for this tank, the designing work has been temporarily suspended, and new studies are being undertaken in anticipation of a higher weight limitation being established.

Medium "A" Tanks, Models of 1921 *and* 1922. The medium tanks, models of 1921 and 1922, have been continued under test at the Proving Ground, and the defects developed during these tests are being corrected by changes in design or material. The principal changes in the model of 1922 tank, which originally had a wire rope cable suspension for the track, have been in the chain suspension, the running gear and track parts, to insure the track remaining in place when turning. Considerable experimental work has been done with the power plants of both of these tanks, and a number of improvements have been made to insure more dependable operation.

Christie Tank. The combined wheel and track-laying tank manufactured by Mr. Walter Christie has been at Camp Meade during the past year, for trial by the using service. The using service has recommended against the continuance of tests of this type of tank and, as a result, the tank has been ordered shipped to the museum at the Aberdeen Proving Ground. No further work will be done on this type of tank at this time.

Corps Tractor. The corps tractor built at the Rock Island Arsenal in accordance with the recommendations of the Caliber Board has been delivered to the Proving Ground for test. Sufficient mileage has been made with it to indicate that the redesign of certain parts of the running gear will be necessary before this tractor can again be placed under test. The tests have shown that this tractor has certain very desirable characteristics. Continued efforts will be made to correct defects as they may develop.

Experimental Tractor. An experimental tractor was completed at Rock Island Arsenal, equipped with the snake type of track, cable suspension, and controlled differential, for the purpose of testing out these three important types of construction in an effort to better the performance and control of track-laying vehicles. While

the controlled differential has worked out satisfactorily in the limited tests thus far conducted, the same cannot be said of the flexible track and track suspension. Generally, results of the tests indicate that it will be necessary to do considerable experimental work before this type may be considered suitable as regular equipment for service vehicles.

Motor Carriages. One of the Mark IX motor carriages for 8-inch howitzer has been sent to the Rock Island Arsenal for re-building after a preliminary test at the Proving Ground. Tests with this carriage indicate that certain modifications are necessary to insure a reasonable mileage, free from major failures, with this very revolutionary type of vehicle. It was for the purpose of improving certain parts of the construction that this vehicle was sent to the Rock Island Arsenal for rebuilding.

Corps Motor Carriages. The motor carriage Mark X, for the 4.7-inch gun, referred to as the "Corps Motor Carriage," has been completed at the Rock Island Arsenal, but has not as yet been delivered at the Proving Ground for test. This is one of the projects initiated in accordance with the recommendations of the Caliber Board.

Divisional Motor Carriage. During the past year, and after a number of tests by the using services of the Mark VI and Mark VII, and Christie type motor carriages for divisional artillery, the Field Artillery Board, in its report, has recommended against the use of this type of equipment in its present state of development. While the motor carriages sent to the Field Artillery Board for test were of the best type constructed to date, they were not sufficiently dependable in performance to warrant a recommendation for adoption for use. As a result of this recommendation by the Field Artillery Board the divisional motor carriage, model of 1924, for some time under design at the Rock Island Arsenal, has been set aside for the present. This design was about 80 per cent completed.

Combination Wheel and Track-Laying Motor Carriage. As a result of the tests of the Christie type of motor carriage for the 155-mm. gun and for the 75-mm. gun, the Ordnance Committee, in separate reports has recommended against the continuance of tests of the type of combined wheel and track-laying vehicles produced by Mr. Christie; this because of the major failures which occurred during the tests. The conclusion to be drawn from the tests of these motor carriages is that the principle of the running gear used is not satisfactory because of the compromise necessary in the design.

Cross-Country Cargo Project. During the past year there was developed the project of developing a cargo vehicle which would be capable of operating across country. This project was initiated in co-operation with all branches of the using services. The initial step consisted in fitting 75-mm. caissons with bodies for handling cargo. Two of these cargo carts were made up at the Aberdeen Proving Gound and, after some preliminary test, were sent to the using services for further trial. If these carts prove successful, there are available in an emergency a large number of caissons which can be readily converted into wheeled cargo carts for use behind tractors.

A second step in this cross-country project was the redesign of an experimental Mark VII tractor caisson, for the purpose of providing a vehicle with the mobility of tanks to follow these as cargo carriers. The design for the modification of these Mark VII tractor caissons was forwarded to the Aberdeen Proving Ground, where the work will be undertaken. Upon completion, the modified tractor caissons will be subjected to a series of tests to determine their suitability as cargo carriers with tank organizations.

Reconnaissance Vehicles. As a result of the failure during the tests by the using services of the reconnaissance vehicles of light track type, the effort to develop a reconnaissance vehicle of the type first constructed has been abandoned for the time being, and effort is now being made to produce vehicles of the wheeled type for reconnaissance work. At the same time, experiments are being continued to develop a light type of track for use on vehicles under 1,000 pounds.

One line of development in this program has been the preparation of designs for converting a Dodge car into a six-wheeled vehicle, the four rear wheels being made up into truck form, and all wheels being driven. Another step in an effort to produce light reconnaissance vehicles has been the conversion, at the Aberdeen Proving Ground, of a standard Ford and a standard Dodge chassis into stripped chassis, equipped with large balloon tires.

The preliminary tests with vehicles of both types indicate their suitability for this work, and such a favorable impression was created during the demonstration tests before the Field Artillery Board and the Infantry Board, that additional vehicles are being made up for trial over a long period by the using services.

Power Carts. Power carts, constructed and tested at the same time as reconnaissance vehicles, of the track laying type, were found lacking in desirable characteristics and, upon the recommendation of the Infantry Board, no effort will be made at this time to rebuild power carts of the type tested. A new type is under construction in accordance with designs prepared at the Rock Island Arsenal, which will embody the characteristics which the tests previously made indicate as desirable.

Commercial Tractors. During the fiscal year tests have been conducted at the Aberdeen Proving Ground with the Holt, Best, and Pavesi, as well as other types of commercial tractors, in an effort to determine their suitability for use in case of emergency for hauling artillery loads. As a result of these tests, and of the tests conducted by the using services, twenty Holt T-35 tractors were procured and sent to Fort Benning, for test. This test has not progressed to a point where suitability of the tractors can be established; but the tests of the first vehicles sent to the using services indicated that satisfactory performance may be expected.

Fordson with Fordson Adapters. Commercial equipment procured for test with the Fordson tractor consisted of Bates Adapter, Hadfield-Penfield Adapter, Full Crawler, and P. T. Wheels. The first mentioned adapters are for use in converting the Fordson into a half-track machine, utilizing the front wheels for steering. The Full Crawler converts the Fordson into a full track-laying vehicle; while the P. T. Wheels are special wheels in place of the ground drive wheels of the regular Fordson equipment. Sufficient tests have been conducted with the two first mentioned types to indicate that while these adapters have some merit, they are not entirely satisfactory for military purposes. Designs have, therefore, been prepared in this office and at the Rock Island Arsenal in an effort to produce a more satisfactory adapter, of the half track, full track, or multiple wheel type. The tests of the Full Crawler adapter have not progressed sufficiently to indicate the degree of service to be expected from this equipment.

During the fiscal year considerable miscellaneous ma-

terial has been tested, among which may be mentioned a special track for use with the 5-ton tractor, involving a number of various kinds of steel and different kinds of treatment, in an effort to determine the most satisfactory material and treatment for tracks of the hinge pin type, as used on the 5-ton tractor and other vehicles. Among other important work undertaken is the preparation of specifications for armor plate. Under existing specifications but few manufacturers could be found willing to undertake its manufacture in time of emergency. Various types of track—such as the Kegress and Belt—have been experimented with at the Rock Island Arsenal in an effort to produce some light track for cargo and similar vehicles. Work on this line is being continued.

Ammunition

Field Artillery Ammunition. Comparatively little ammunition production for field artillery was carried on during the year. Orders were placed for the manufacture of 1,500,000 rounds of caliber .30 sub-caliber ammunition; also for the manufacture of 1,200 2.24-inch cannister.

One thousand complete rounds of 75-mm. ammunition, and 1,000 complete rounds of 155-mm. howitzer ammunition were completed during the year. This ammunition was assembled using F. N. H. Powder. A portion of these rounds contained powder manufactured at the Picatinny Arsenal, the balance powder manufactured by the DuPont Company. The shells were equipped with the E-13 fuze. Before sending these rounds to the service for test, samples were subjected to test at the Aberdeen Proving Ground. In these tests the behavior of the fuze was unsatisfactory, and it was decided that these rounds be not sent to the service until after the defects in the fuze have been corrected. Efforts have been made along this line, but up to the present time the results have not been entirely satisfactory.

Orders were placed during the year for the manufacture of 900 complete runds of 105-mm. ammunition, and 150 complete rounds of 75-mm. ammunition for the model of 1920, 75-mm. gun. This ammunition is to be equipped with F. N. H. powder and the E-13 fuze. The powder is being procured from the DuPont Company. Upon completion, this ammunition will be sent to the service for test.

Fuzes. Development work has been continued on the E-13 fuze, but considerable work and tests remain to be carried out. The manufacture of an experimental lot of 200 fuzes for use in tank gun ammunition has been completed. Tests will be carried out to determine the suitability of this type of fuze for use in tank gun, and antitank gun ammunition. Manufacture of two experimental lots of super-sensitive fuzes has been in progress during the year. Preliminary tests with both lots have been satisfactory.

Propellant Charges. Development work has been continued with respect to a flashless, non-hydroscopic powder thus far with very encouraging results. The DuPont Company has undertaken the development of an F. N. H. powder for the 3-inch antiaircraft gun.

Saluting Charges. To obviate the use of loose, black powder in the field, saluting charges for the 37-mm. and 75-mm. guns have been developed, so that these charges may be issued in a made up condition.

Ammunition for the following new types of weapons, for development and service tests, has been issued or is being prepared:

37-mm. Collt Automatic Gun (2,000 f. s.).
37-mm. Infantry Gun, Model of 1925.
75-mm. Infantry Mortar, Model of 1922.
2.24-inch Infantry Mortar, Model of 1922.
75-mm. Pack Howitzer, Model of 1923-E.

Seacoast Artillery Ammunition. Assembly of complete rounds of 3-inch antiaircraft ammunition proceeded during the year. Ten thousand rounds of shrapnel and 8,000 rounds of high-explosive shell ammunition were completed. This ammunition is equipped with the Mark II, type " S " time fuze. In the acceptance tests of lots of this ammunition the results obtained, so far as the fuze is concerned, were not entirely satisfactory. A program has been drawn up which has in view the determination of the suitability of the Mark III Scovill type antiaircraft fuze for use in the 3-inch antiaircraft gun. This type of fuze was originally designed for the 75-mm. antiaircraft gun, but it is believed that it can be adapted for use in the 3-inch antiaircraft gun.

The bag-loading plant at the Picatinny Arsenal has been in continuous operation during the year, loading propelling chares for the 16-inch gun, the 16-inch howitzer, and the 14-inch and 12-inch guns. After the installation of a new turn table in the "D" loading plant at the Picatinny Arsenal, operation of this plant was practically continuous throughout the year.

Dummy Charges. Dummy charges for the 16-inch gun, model of 1919, and the 16-inch howitzer, model of 1920, have been developed at the Rock Island Arsenal, and one of each has been manufactured. These dummy charges will be shipped to coast defense posts for test. If found satisfactory, additional charges of both types will be made.

Pyrotechnics. A new type of airplane landing flare, designated as "Type 3," was developed at the Picatinny Arsenal during the year, and samples were sent to McCook Field, for test by the Air Service. Generally speaking, the flare was satisfactory, although certain minor changes have been recommended by the Air Service. Development work to accomplish these changes is in progress, but the results sought have not yet been attained. In view of the urgent requirements for flares for issue, it has been decided to manufacture and issue 300 of these flares, and this work is now in progress. Upon request of the Post Office Department, 50 of the "Type 3" flares have been sold to that Department.

Development work on white wing tip landing flares is proceeding, and recently a sample of 25 flares was submitted for test. Six flares were tested with very satisfactory results, and it is believed that the defects in the white wing tip landing flare have been corrected. Service test of the new type of flare is contemplated; if satisfactory results are obtained, application will be made for the standardization of the type, and manufacture will be begun on production basis.

Development has continued during the year on a pyrotechnic signal cartridge for both the Air Service and ground troops. In the original design of the signal cartridge for ground troops, black powder was used as a propellant. It has been found in firing these signals that the position of the rifle is disclosed by reason of the smoke which is given out by the propellant. Studies are now in progress having in view the substitution of smokeless powder as a propellant. In this connection it will be necessary to work out a smokeless powder which will

give the required height of projection. Experimental types of different airplane signal cartridges have been tested, but difficulties were encountered in distinguishing the various colors. For this reason it has not been possible to standardize any additional signals for Air Service use.

Bombs. Loading of bombs was continuously carried on throughout the year. An order for seven hundred 1,100-pound bombs, and two hundred 2,000-pound bombs was completed. Approximately sixteen hundred 600-pound bombs were loaded during the year.

Nitrates. Nitrate Plants Nos. 1 and 2, located at Sheffield and Muscle Shoals, Alabama, respectively, have been maintained as a reserve source of nitrates, to be used in case of emergency. Although substantially in stand-by condition, certain parts of the plants have been in use during the year. The lease of November 17, 1921, covering the 60,000 kilowatt steam electric power plant at Nitrate Plant No. 2, was renewed by the Alabama Power Company, which company also leased the Waco Sub-Station during the year. By the terms of these leases the War Department is relieved of the maintenance of the property, and obtains a substantial revenue amounting to several times the total amount expended for the maintenance of the Nitrate Plants. The Warrior Power Plant, and the Warrior-Muscle Shoals Transmission Line, were sold to the Alabama Power Company on September 24, 1923, for the sum of $3,472,487.25.

Research and Ballistics

During the year the Ballistic Section completed 21 manuscripts of firing tables for various guns; 10 were published and distributed to the using services. In addition, Volume I of "Exterior Ballistic Tables Based on Numerical Integration" was published. Work on Volume II of these Tables is in progress. "Ordnance Technical Notes No. 1, The Equations of Motion for Interior Ballistics," was published and distributed. Several technical notes are in course of preparation. Research work on various ballistic problems is under way.

Specifications

The preparation of specifications to be available in an emergency is a matter of much importance. To be really helpful specifications must be of such nature that they will be acceptable to the commercial world. This requires considerable time and effort, and the Department has been working during the past year to increase the number of specifications completed. To facilitate this work specific personnel have been appointed in this office to devote all available time upon the subject.

Gages

The question of gages for use in quantity manufacture in a national emergency is also a most serious one. There are on hand, as a result of the World War, many thousands of gages. A considerable amount of work has been done in verifying these gages, checking and placing them in storage. From this record there is being drawn up a list of the gages which would be required should another emergency arise. In addition, beginning with the more important items, work is being done to fill up the deficiencies which exist in the gages actually in stock. This is work which will require a considerable amount of money and time. A special item was included in this year's appropriation to facilitate this project, and the work will be continued until a satisfactory condition shall exist.

Supply and Maintenance of Materiel

During the past year the Ordnance Department carried out its functions in connection with the supply, inspection, repair, and maintenance of matériel as satisfactorily as the limited funds available would permit. Storage conditions of ordnance matériel in storage at permanent ordnance establishments were materially improved and, in general, stocks at the strategically located corps area ordnance issuing establishments were maintained within satisfactory limits. Extreme shortages of transportation funds, however, precluded the possibility of replenishing local stocks to any considerable degree. This necessitated in many instances less-than-carload-lot shipments over long distances, a procedure manifestly uneconomical. Satisfactory progress was made during the year in the administration and training for their field duties of all Ordnance Companies.

Supply. The past fiscal year has been reasonably successful in so far as the movement and equalization of stocks of ordnance supplies is concerned. The funds allocated for transportation, although insufficient, have permitted of increased movement of stocks between establishments in this equalization process, as compared with the preceding year. This equalization of stocks has resulted in more economical handling, economy in transportation expense in issuing to troops, and more satisfactory service. The project, while far from completion, will be continued during the fiscal year 1925, provided adequate transportation funds are made available.

The issue of parts for the maintenance of ordnance equipment in the field has been satisfactory, although the stock of such parts is rapidly diminishing. It has been necessary to complete unfinished parts held in reserve in order to meet the growing demand and replenish depleted stocks.

The revised method of securing reports covering major items of ordnance equipment has, with a few exceptions, been satisfactory. The exceptions, in general, were due to the inability of some to definitely identify certain items of special types. These reports, now submitted through Corps Area and Department Commanders, have enabled this office to comply with the numerous requests received from various military sources for information as to the status of items in the hands of troops and in post, camp, and station storage.

The compilation of Ordnance Equipment Charts and Standard Nomenclature Lists for the more definite placement and identification of ordnance supplies continues to improve. Approximately 85 per cent. of the Equipment Charts have now been compiled and approved by the using services. During the year numerous Standard Nomenclature Lists have been compiled and printed. An innovation in these lists is the insertion of prices, thereby eliminating War Department circulars previously published for this purpose.

During the latter days of the last Congress, legislation was enacted providing for the distribution of the captured enemy war devices and trophies, and approved by the President, June 7, 1924. This act authorized an appropriation of $39,000.00 to cover the packing and loading of the trophies, and the payment of transportation charges to certain of the government establishments, such as National Parks, monuments, etc. Steps were immediately taken to inform the Chief Executives of the various States and Territories of the provisions of this act, in order that they might make their tentative allo-

cations, so that when the funds are made available by Congress, the trophies can be moved without delay.

One of the larger activities during the year consisted of exchanging the 3-inch gun equipment in the hands of R. O. T. C. units for the 75-mm., model of 1897, equipment. This exchange made uniform the equipment of all light field artillery organizations in the United States, and will tend, therefore, to reduce maintenance expenses.

Maintenance

The maintenance activities of the Ordnance Department during the past year were quite satisfactory, considering the limited funds available. Matériel in the hands of troops and in storage was, in general, satisfactorily maintained. Annual inspections showed the matériel to be in first-class condition. During the summer training camp period Ordnance personnel consisting of detachments of Ordnance Maintenance Companies assigned to troops and to manufacturing arsenals rendered satisfactory service, maintaining in first-class serviceable condition the ordnance matériel at such camps. The following outline shows the principal maintenance operations during the fiscal year.

Maintenance in Hands of Troops. $471,355.44 have been allotted to ordnance officers in the field for the purpose of maintaining ordnance matériel in use by the Regular Army. In general, this matériel has been maintained in a satisfactory condition. The maintenance of tanks at Camp Meade has suffered, due to the fire in the riding hall, December 25, 1923, which caused damage which it will cost approximately $26,000.00 to repair. As funds are not available from current appropriations, it will not be possible to repair this damage until funds shall have been provided under the 1926 appropriations, and, therefore, a number of 6-ton and Mark VIII tanks on hand at the end of the fiscal year are in an unserviceable condition.

Maintenance in Storage. $309,655.63 were allotted during the fiscal year for the purpose of maintaining ordnance material in storage at ordnance establishments. The value of this material is approximately $500,000,000.00, exclusive of ammunition.

Spare Parts. $162,212.35 were allotted during the year for the procurement of spare parts, which amount does not include some expended for replacement parts issued with reimbursement. Every effort is being made to keep on hand sufficient spare parts to permit the prompt filling of requisitions. While there has been no marked shortage of parts up to the present time, it is felt that unless appropriations for spare parts, particularly spare parts for tanks, are increased, serious shortages will soon result. Approximately $100,000 worth of spare parts for 6-ton and Mark VIII tanks are required for replacement of stock due to issues during the present fiscal year, whereas but $20,000 is available for this purpose. Obviously, steps must be taken to provide adequate funds for this purpose, or the number of tanks in current service must be reduced.

Modifications. A number of modification work orders have been issued during the fiscal year, making improvements in ordnance matériel to increase its efficiency, and to reduce the cost of maintenance in service. A considerable part of this modification work applies to 6-ton tanks.

Overhaul. $74,171.40 were spent during the fiscal year on overhaul of ordnance matériel in storage, as follows:

$15,765.85 for overhaul of rifles, pistols, revolvers and other small arms.

$40,573.00 for overhaul of mobile artillery and fire-control instruments.

2,704.00 for overhaul of seacoast guns and carriages and fire-control instruments..

15,128.55 for overhaul of miscellaneous ordnance matériel not covered by other appropriations.

At the end of the fiscal year there remains on hand, in storage, matériel in unserviceable condition which must be overhauled before it can be issued. It will require the expnditure of approximately the following amounts for such overhaul:

Machine guns and automatic rifles	$ 75,000.00
Rifles, pistols and other small arms	400,000.00
Mobile artillery matériel	600,000.00
Tanks	51,000.00
Seacoast matériel	40,000.00

The matériel requiring overhaul is being thoroughly studied, taking into consideration the requirements for the Two-Army Program, with a view to conforming to that program as far as practicable, considering the particular matériel involved.

The second training course for ammunition foremen for duty in continental corps areas was conducted at the Picatinny Arsenal. One of these men has been assigned to duty in the Fourth Corps Area. The armament foremen of the Fifth, Sixth, and Seventh Corps Areas successfully completed the course, and in future they will function as ammunition foremen in addition to their duties as armament foremen. Ammunition foremen have now been provided for the Panama, Hawaiian, and Philippine Departments, also for each continental Corps Area.

During the past fiscal year a committee of ordnance experts on the storage of powder was appointed to study the subject of under-water storage of the reserves of smokeless powder. After careful consideration of all data pertaining to this problem, a report was submitted wherein the Committee recommended that all reserves of bulk smokeless powder in excess of the amount required for new manufacture in the next two years should be stored under water, and that all smokeless powder propelling charges in excess of the number of projectiles of each caliber on hand, plus the manufacturing program for the next two years, be also stored under water. It has been found that powder deteriorates much more rapidly in dry storage than in wet. In fact, during the calendar year 1923, at the Charleston Ordnance Reserve Depot, two magazines and their contents were destroyed, presumably due to spontaneous combustion resulting from deterioration of the smokeless powder in storage in the magazine. Under-water storage of stocks of smokeless powder will, it is believed, serve to prolong the life of the powder, and postpone the day on which it will have to be replaced by new manufacture. In addition, powder in dry storage requires careful surveillance, with the resulting expense of conducting numerous and detailed surveillance tests from time to time of samples of the powder, maintaining the magazines in which the powder is stored, plowing fire-breaks around the magazines to prevent fire hazards, etc. If the reserves of smokeless powder are stored under water this expense will be avoided, resulting in a continuous saving to the Government each year. In time these accumulated savings will exceed the actual cost of placing this powder in wet storage, in addition to the indirect saving which will be attained from the prolongation of the life of the powder.

Approximately 52,000,000 pounds of smokeless powder have been stored at the Old Hickory Ordnance Reserve

Depot. This powder is required as war reserve, and the contract for the sale of the Old Hickory Powder Plant to the Nashville Industrial Corporation provides free storage for this powder to the United States until November, 1925. The Ordnance Department, therefore, is faced with the immediate problem of shipping this powder to other storage. The cost of making such shipment would amount to approximately $1,153,000.00, whereas the cost of building a suitable pit and storing the powder under water at the Old Hickory Ordnance Reserve Depot would amount to less than half this sum. A site has been selected on the grounds of the Old Hickory Ordnance Reserve Depot where a concrete pit can be constructed in which to store, under water, the reserve of smokeless powder at that station. In addition, tentative sites have been selected at other ordnance establishments where the excess stocks of bulk smokeless powder and smokeless powder charges can also be stored under water. An item to cover the entire program has been included in the estimates of the Ordnance Department to be submitted for the fiscal year 1925.

After the close of the fiscal year 1924, and while this report was in preparation, a serious fire occurred at the Old Hickory Ordnance Deport, in which a large part of the powder referred to in the preceding paragraph was destroyed, together with many buildings, plants, etc.

On March 1, 1924, a disastrous explosion occurred in the plant of the Ammonite Company, adjacent to the Raritan Arsenal. The entire plant was destroyed, resulting in eight deaths and many injuries. Considerable property damage resulted to the Raritan Arsenal. Three magazines were destroyed, while nineteen others suffered varying degrees of damage. Steps have been taken to remove the stocks of ammunition stored in the wrecked magazines and to repair the damaged buildings. It is believed that this explosion is indicative of the excellent storage conditions of ammunition and explosives at the field storage depots of the Ordnance Department. Many of the magazines which were wrecked or otherwise damaged contained high-explosive shell. The intensity of the blast is apparent from the fact that three of the magazines were leveled to the ground. However, no fire or explosion occurred at the Raritan Arsenal as a result of the blast at the Ammonite plant.

Salvage

The Ordnance Salvage Board, under existing law and orders, is charged with the disposal of all personal property, other than transportation, which becomes surplus in the Ordnance Department. This surplus property may be transferred to other branches of the War Department, or to other departments of the Federal Government. Such as is not so transferred is sold by the Ordnance Salvage Board under specific authority obtained in each instance from The Assistant Secretary of War.

On February 1, 1924, the Philadelphia District Ordnance Salvage Board was consolidated with the Frankford Arsenal. This was the last of the independent offices of the Salvage Board, and its consolidation with the Arsenal completes the absorption of surplus property activities by the permanent organization of the Ordnance Department.

Practically all salable stocks of surplus ammunition, or components thereof, have been transferred or sold, and arrangements are now being perfected to provide for the disposal of future quantities under authority conveyed by Army Regulations.

The principal source of surplus during the past year has been the reduction in stocks held by manufacturing arsenals; but in compliance with the instructions contained in a letter from The Assistant Secretary of War under date December 27, 1923, strenuous efforts have been made to complete this work, and no more new surplus now exists which requires the action of the Ordnance Salvage Board. The remaining activities of this organization are confined to: (first) Completion of disposal of surplus previously reported; (second) Management of existing uncompleted contracts covering sales; and (third) Settlement of differences on past sales and defense of claims arising from past transactions.

Following is a statement of the business of the Ordnance Salvage Board for the past fiscal year:

Value of property transferred	$10,831,290.19
Contract returns from sales made during the year	8,013,841.55
Payments received on prior contracts	2,045,145.64

In accordance with instructions of the Secretary of War, the Ordnance Salvage Board ceased to exist as a separate entity on July 1, 1924, on which date its remaining functions and activities will be assumed by the Contract Section, Administration Division, Office of the Chief of Ordnance.

Repairs and Improvements

In my report for the fiscal year 1923 I invited attention to the inadequacy of the funds appropriated under the heading "Repairs of Arsenals," for repairs and improvements of buildings and grounds pertaining to the Ordnance Department. The conditions there outlined not only still obtain, but, because of continued deterioration in the meantime, have become more aggravated. The increase of the amount so appropriated to a sum which will permit reasonable maintenance of this valuable property is essential to efficient and economical administration.

Activities of New York Post, Army Ordnance Association

MAJOR W. B. HARDIGG, Chief of the Ammunition Division, Office of the Chief of Ordnance, delivered a very interesting and instructive lecture before the Ordnance reserve officers and manufacturers assigned to the New York Ordnance District, at the Engineers Building in New York, on Monday evening, February 23rd. Mr. William H. Woodin, member of the Advisory Board of the New York Ordnance District and president of the American Car and Foundry Company, presided at the meeting, which was one of the series arranged by Colonel James L. Walsh, New York District Chief, for the 1924-1925 season.

The New York Post of the Army Ordnance Association has arranged for three meetings of the Post to be held before the close of the season's activities. At the first of these, Colonel J. C. Heckman, Ord. Res., Chief of the Facilities Section of the New York Ordnance District, will address the meeting. This lecture which will be illustrated and will discuss munitions storage and supply should prove of interest to all members.

The Role of Malleable Cast Iron in Ordnance

By

ALFRED G. ZIMERMANN

IT took a near-calamity to demonstrate that our vast, war-mobilized steel industry could be tied up so completely with existing contracts and obligations that not another contract could be let anywhere in the country with any hope of work being started for many months to come. It happened in connection with the armament program for the new destroyers which were even then being merrily launched by the scores in the flurry of war production and would soon be ready for their teeth. The plans for arming them had been well laid, the necessary priorities for manufacture and shipment of parts had been secured and there was even a little time to spare, when the assembling plant reported that almost every 4-inch gun yoke they started to machine was found to be defective after the skin of the casting had been removed.

This was serious, for every yoke required had long since been made and the stock yard had been littered with them for months, waiting for the guns to catch up. The guns were now ready and what had appeared to be a complete order of good steel gun yokes, inspected, passed, stamped and in most part paid for, vanished into thin air and in its stead was an equal bulk of almost uniformly defective castings. Replacements by the same contractor were out of the question, because even if he learned how to make good yokes, his output per day was too picayune to be of any use in making up the handicap in time caused by the collapse of the previous lot. It was then that a survey was made of the entire steel resources of the country. Although armed with the highest war priority obtainable, and a pathetic emergency story to boot, manufacturers uniformly produced domestic or allied priorities of equal precedence to which they had already committed themselves and which absorbed their resources for a long time to come.

It took both courage and ingenuity to cut the Gordian knot, which was finally accomplished by using those imperfect yokes which still gave evidence of possessing the requisite strength. This course has since been justified by the fact that no yoke has failed in service, although many a careful gunner has pointed an official finger at obvious imperfections discovered while overhauling his battery. The moral of the tale, however, is to call attention to the fact that in any future major war effort, we will agan find our steel resources obligated up to the last ton, and anything which can be done in advance to divert tonnage from steel to materials less urgently in demand, will be a commensurate help.

This brings us to a consideration of that distinctive American industry, the making of "black heart" malleable iron castings. Seth Boyden, in his little foundry at Newark, New Jersey, stumbled on the process while endeavoring to duplicate the vastly inferior European "white heart" malleable iron in 1826. The industry has grown slowly, but steadily, and has long occupied a permanent place among the activities of this country. The production in 1919, according to H. A. Swartz, was slightly over 800,000 tons, and in 1922 the capacity of the malleable iron plants of this country was estimated at 1 200,000 tons. During the war the production swelled beyond that maintained immediately after, but this was due not so much to war orders directly, as to the fact that the industry received orders for commercial articles nominally made of steel, which the steel industry could no longer handle due to the priority of war material.

It may not be amiss to review at this point the characteristics of malleable cast iron. For purposes of comparison, examples of gray cast iron are shown in figures 1A and 1B. Much of the carbon in the material has been precipitated in the characteristically shaped graphite flakes which contribute both to the color of the fracture and the brittleness of the product. White cast iron, as seen in Figure 1C, has very little precipitated graphite much of its carbon is still in the combined form of a light colored carbide. It is this grade of cast iron which can be transformed into malleable cast iron by prolonged heating while surrounded by a suitable packing.

The progress of malleableizing, which takes about seven

A B C

Fig. 1. A. Gray cast iron—unetched. x100. B. Same as A—etched. x 100. C. White cast iron—unetched. x 100.

A B C

Fig. 2. A. Partially malleableized—unetched. x100 B. Partially malleableized—etched. x100 C. Fully malleableized—etched. x100

days, may be followed in figures 2A to 2C. The small nodules of Figure 1C have increased in size (see Figure 2A) and the reason is shown in Figure 2B. The combined carbon of the surrounding areas has been broken down, adding to the size of the graphite nuclei and leaving the drained areas rich in free ferrite (these appear white in the photomicrograph). This process goes on under the influence of heat until the bulk of the material is reduced to ferrite and graphite. Ferrite is a soft, ductile constituent and the amorphous carbon occurs in characteristic rounded masses which have not the weakening effect that the thin, sharp-edged flakes found in gray iron have. The effect of these sharp discontinuities in gray iron is accentuated by the fact that their indiscriminate orientation makes the material weak in all directions, unlike wrought iron, shown in Figure 3, which has similar planes of weakness, but their alignment makes the material strong in one direction, like a rope. Of course, in the case of wrought iron, the discontinuities are strings of slag and inclusions, surrounded by the light constituent ferrite.

Malleable cast iron has long been used for pipe fittings and in the railroad industry for miscellaneous parts and draft gear, where its superior rust and shock resisting properties were utilized to advantage. Perhaps nothing can show so clearly how this product has forged ahead among engineering materials as a brief summary of the specifications in effect at various times. These represent minimum values which were demanded by purchasers and reflect also what the average foundry could produce. In 1913 the Navy Specifications prescribed a tensile strength of 36,000 pounds per square inch with a minimum elongation in two inches of 3 per cent. In 1916 the American Society for Testing Materials adopted a tensile strength of 38,000 pounds per square inch with an elongation of 5 per cent, and was followed a year later by the Navy. In 1921 the A. S. T. M. Specification was again raised to 45,000 pounds per square inch and 7½ per cent elongation, while the Federal Specification Board, in 1924, adopted 50,000 pounds per square inch and 10 per cent elongation as a minimum requirement. There is one characteristic not mentioned in the specifications which is possessed by malleable cast iron to a remarkable degree—shearing strength beyond that which would be expected of material of its tensile strength.

Fig. 3. A longitudinal section of wrought iron—etched. x100

Material of these characteristics should certainly have its place in ordnance construction and equipment. It can be used in many places where bronze gives trouble on account of the difference of potential between it and the surrounding steel. Various types of training apparatus and designs mounting optical systems, such as gun sight yokes, are fertile fields for this product. As an example of what can be done, the Navy 4-inch gun sight yoke may be mentioned. This yoke is a long, Y-shaped, steel casting of thin cross-section, rather difficult to pour successfully. A contractor who had a large contract for them during the late war found it impossible to get steel castings acceptable to the inspector and in desperation offered malleable cast iron, which he found could be made to this design with ease. After an exhaustive examination of the casting submitted, the Department declared its willingness to accept malleable cast iron sight yokes. Unfortunately for the new material, the contractor had in the meanwhile radically changed his foundry practice, and finally succeeded in producing enough steel castings to keep up with the rest of the mount program.

There was another case about this time in which the substitution was actually made with beneficial results. The Navy's 3-inch dummy cartridges, used for drill purposes, have wooden bodies, with steel points and bases. These bases had narrow rims which were being constantly chipped off by the action of the extractors, rendering the cartridge useless for drill purposes. Malleable cast iron was prescribed as a substitute, and not only did the complaints from the service cease with their use, but the contract price of $11,000 represented a saving of $5,000 on the price of an equal number of steel bases.

Sufficient data have here been reviewed to warrant the suggestion that Ordnance designers should not lose sight of this very dependable material. A distinctively American industry is exclusively engaged in producing it, and it can easily share more of the war burden of the steel industry than it has heretofore. Its occasional substitution for bronze will not only keep down electrolytic corrosion, but will help to lessen the number of parts for which tin bearing materials must be furnished in time of war. Our experience with the price of tin during the last war, when all seas were open to us, is only a small indication of what can be expected during the next war if our commerce were partially or wholly restricted.

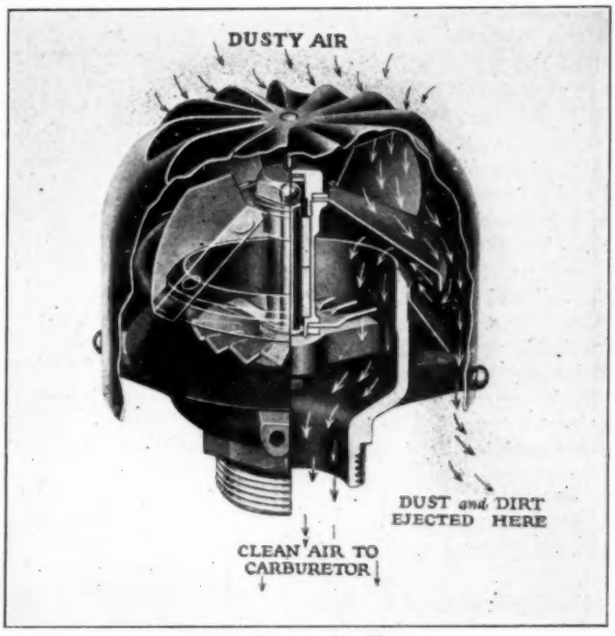
Air Clarifiers

By

KENNETH B. HARMON

INCREASING attention is being directed to devices for removing dust from the air entering the cylinders of automotive engines through the carburetor. This dust containing a varying percentage of grit mixes with the cylinder oil and forms an effective grinding compound. The destructive effect is not limited to the cylinders, for the dust passes into the crankcase and attacks the bearings as well.

For some time recognized as a necessity on the majority of tractor engines, the air cleaner is gaining recognition as a necessity on trucks and automobiles operating on dusty roads. Even under ordinary conditions it may be considered as at least a refinement on any internal combustion engine driving a vehicle. Where not required to protect against rapid destruction, the cleaner will maintain the motor in a higher state of efficiency and prolong its life. With these considerations in mind, automobile manufacturers are beginning to adopt air clarifiers as standard equipment.



United Ejector Air Cleaner

The entering air meets the rotating vanes which whirl the air and throw out the dust. The cleaned air continuing past the small wind mill actuates it, giving motion to the rotor

The need for such protection is much greater in some localities than in others, and is particularly great in the West and Southwest. Tractors operating in the fields are often completely enveloped in clouds of dust, and much of it is necessarily taken into the motor. Operating under the worst conditions, without the protection of a cleaner, a tractor motor will be rendered useless in one or two days. Automobiles operating on old macadam, gravel or dirt roads are subjected to considerable dust and this sometimes amounts to a great deal when traffic is heavy. Even on the best roads a certain amount of abrasive dust is taken into the engine.

Obviously the abrasive quality of the dust is more marked in some localities than in others. It is particularly bad in sandy regions and regions having soil of a silicious nature, but it is safe to assume that there is enough abrasive in all dust to merit its elimination.

There are so many different air cleaners on the market that no attempt will be made to describe them all in detail. The basic principles of practically all of them can be classified under one of the following groups:

Liquid cleaners,
Inertia cleaners,
Filter cleaners.

To these there may be added before long, electric cleaners, but to-day these latter are still in the experimental stage.

The liquid cleaner is so arranged that the entering air must pass through water or oil, or be mixed with spray, which, together with the dust it collects, is later precipitated. In passing through liquid the air must be finely divided into small bubbles to assure effective cleaning. This class of cleaner when using water, has the virtue of introducing some moisture to the cylinders, thus reducing carbon formation and improving operation. If all the water is permitted to evaporate and the engine continued in operation, dust will be taken in. In very cold climates the water cleaner would be useless unless protected from freezing.

The inertia group of cleaners takes advantage of the relatively high inertia of the dust particles. The path of the incoming air is abruptly changed so that the dust tends to be thrown out. This is accomplished in two general ways—one by causing the air to rotate in a circular chamber provided with sloping vanes or tangential inlet passages, or with a revolving paddle, or any arrangement which will give the incoming air a whirling motion. This sort of cleaner is usually referred to as a centrifugal cleaner. The dust is thrown to the periphery and clean air drawn from the center. The other arrangement usually involves placing the cleaner in the blast of the cooling fan and depends on the high velocity of the dusty air to make it difficult for the dust particles to turn the abrupt corners which must be negotiated by the air in order to reach the carburetor. The variation of arrangement may be almost endless.

The great advantage of the inertia type of cleaner is that it may be made self-cleaning. The separated dust may be ejected directly into the atmosphere and need not be collected in a container to be emptied from time to time. For this reason particularly and also because of its small size it bids fair to be the type most acceptable to automobile manufacturers. It need not be a great deal larger than the carburetor and once installed should require little attention.

The filter cleaners may be divided into two classes—those in which the filter material is saturated with oil, and those in which the filter material is dry. The former class

usually employs for the filter a fibrous material such as hair or vegetable fiber. This is packed tightly into a container and oil poured over it. The air is constrained to pass through this oily mass and the dust adheres to the oil film on the fibers. In cleaning the filter, gasoline or kerosene poured through it washes out the collected dust and incidentally most of the oil. Fresh oil must be applied after cleaning.

The dry filter employs one or more thicknesses of some fabric such as eiderdown cloth or felt through which the air must pass. The collected dust is removed by shaking the cloth or tapping the frame to which it is attached.

To be entirely successful a cleaner must do more than remove dust from the air; it must do this with as little attention as possible—preferably none at all—and it must offer very little resistance to the air passing to the carburetor. The majority of users are very neglectful and the effect of this on a cleaner is to render it inoperative or to permit it to clog up so that the engine cannot get enough air and so becomes weak and sluggish. In order that the air resistance may be low, the cleaner must be of generous capacity—filter type cleaners must present large areas of filter surface to the air. Some oiled filters are supplied with a surplus of oil and so arranged that it is kept flowing over the filter surface washing off the collected dust. On farm tractor work a filter cleaner may require cleaning once a week or several times a day, depending on the character of the soil and type of cleaner used. The liquid type cleaner requires a fresh supply of liquid at a less variable rate (probably not less than once a day) since loss by evaporation progresses when the engine is running regardless of the amount of dust encountered. In this respect the inertia type cleaner has a distinct advantage; since, as mentioned before, it can be made self-cleaning.

A combination of cleaners which places an inertia cleaner in front of a filter cleaner has not been overlooked, and several designers have combined the two in a single cleaner with obvious advantages.

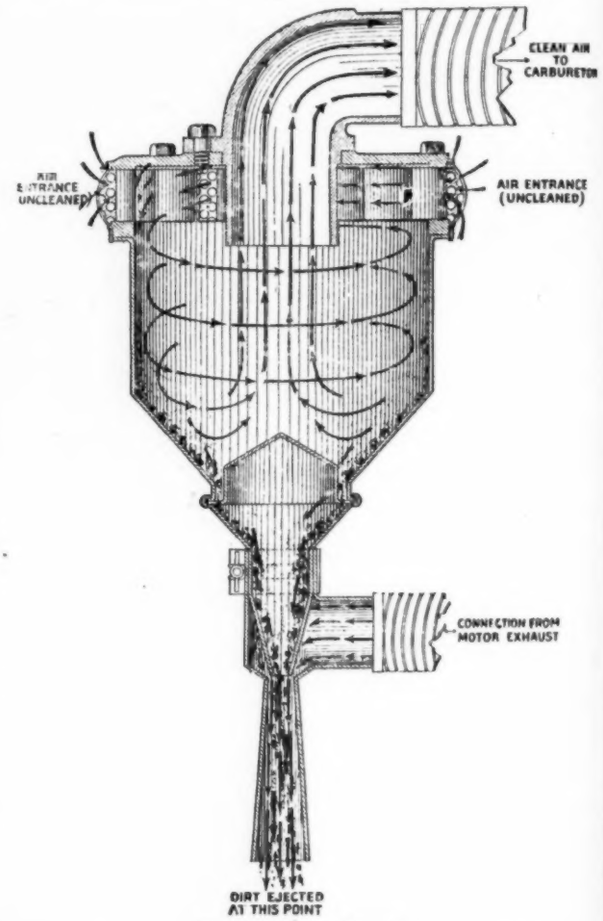
The satisfactory operation of a liquid cleaner is often hindered by the rough motion of the tractor which causes the liquid to slosh about. Cases have been known where the water in such a cleaner was carried over in bulk to the carburetor.

The efficiency of a cleaner is represented by the percentage which it eliminates of the total dust in the air handled. Its usefulness, however, is also effected by the amount of resistance it offers to the passage of air to the carburetor. This latter characteristic is measured as the difference between the pressures at the inlet and the outlet of the cleaner and is the rise in vacuum due to its insertion in the air line. It is expressed in inches of water.

It is evident that the determination of efficiency may be made under widely varying conditions, and that when this is done no comparisons of data can be made to determine relative efficiencies. Indeed, the conditions can be so arranged as to produce for some cleaners figures of apparent efficiency much higher than they merit. Among these conditions the selection of the dust to be used is perhaps the most important consideration. Fullers earth and flour are representative examples of substitutes for field dust.

Fortunately for the farmer, who is the most interested user of air cleaners, a standard test for efficiency has been developed and put into operation by Professor Arthur H. Hoffman, of the Agricultural Engineering Division of the University of California. With his carefully developed apparatus he has tested the majority of the cleaners on the market and the results have been published in Agricultural Engineering (Vol. IV, Nos. 6 and 7, June and July, 1923) and in the Journal of the S. A. E. (Vol. 15, Nos. 1 and 2, July and August, 1924.) Professor Hoffman's articles are recommended as of the greatest value to anyone interested in the subject.

The details of Professor Hoffman's test are too elaborate to be covered here. The salient features, however, must be mentioned to establish its authenticity. First and



Stromberg Air Cleaner

Dusty air enters tangentially and rotates in chamber, throwing out dust which falls to bottom and is ejected by action of the exhaust gases

foremost he uses a "standard" dust. It is, of course, an arbitrary standard, but it is as cosmopolitan as it seems worth while to make it. It is, at least, truly representative of agricultural California.

Samples of soil from ten districts are dried, pulverized, and then floated in the air in a chamber equipped with shelves on which the dust can settle. These air floated samples are then blended and 1 per cent of fine sand added and the whole thoroughhly mixed and dried. Fifty grams of this composite dust constitutes a standard test sample.

In feeding the sample to the cleaner under test, the dust is placed in a rectangular metal tube. A slowly moving plunger in the tube ejects the dust against a revolving bristle brush which sweeps it into the air stream passing to the cleaner. This part of the apparatus is enclosed in a cage with eiderdown cloth walls which filter the air used in the test. Means are employed to avoid the loss of any of the dust in the test sample.

An absolute cleaner is interposed between the cleaner under test and the carburetor of the engine used in making the test. This serves to catch all the dust passed by the first cleaner and is so arranged that the weight of dust

Donaldson Combination (Duplex)
Showing an arrangement where a centrifugal cleaner is placed in front of an oiled filter

reaching it can be determined accurately. It is this weight, in fact, which is used to determine inversely the efficiency of the cleaner under test. The direct method of weighing the tested cleaner itself before and after the run to determine the amount of dust it catches has been found mechanically impracticable due to the limitations of scales and the wide divergence between the weight of the cleaner itself and the weight of the dust it catches in a test run.

A tractor engine is used in the test. It is operated under a Prony brake load. A venturi meter measures the flow of air to the carburetor. A U-tube manometer is connected across the tested cleaner to measure the rise in vacuum due to its insertion in the air line. All pertinent data are recorded and in all respects the tests are so conducted as to leave no room for practical criticism.

Some general statement of the efficiencies which may be expected from the different classes of cleaners is in order. Professor Hoffman's tests show that cleaners of the inertia type will show efficiencies from less than 40 per cent to as high as about 88; those of the liquid type from about 85 per cent to about 98 per cent; and those of the filter type from about 97 per cent to above 99 per cent. The vacuum caused by most cleaners is low when they are clean. It varies from less than an inch of water to about 9 inches. As dust accumulates in a cleaner the vacuum, of course, rises—in some cases more than in others. Increasing the load on the engine naturally raises these figures materially for all cleaners; the inertia type running up to about 13 inches, the liquid type to about 11 inches, and the filter type to as high as 27 inches. It should be understood that the variations in each class are very wide, and that the figures given above are to be considered in the most general sense.

In so far as the tractor is concerned, it is only proper to comment on the circumstances which have made the use of an air cleaner more important in late years. Almost all of the older tractors were rather large in size so that the carburetor or air intake was fairly high above the ground. Furthermore, appearance was hardly a consideration, and there was no objection to the addition of a periscopic intake pipe to increase this height. Thus the dusty air was, to a great extent, avoided. Even today the use of a suitable periscopic intake will render a cleaner unnecessary under nearly all conditions.

Another point is that some of the more recent tractors are equipped with higher speed engines than their predecessors. For example, where engines formerly ran at about 750 revolutions per minute, some now run at about 1,000 revolutions per minute. Thus the piston travel is increased about 33 per cent and the rate of wear is increased in proportion.

Finally, the road speed of the tractor has been increased and this results in a greater disturbance of the soil so that there is more dust to contend with.

The military tractor is subject to use for a great variety of purposes and in all sections of this or any other country. In selecting its cleaner, therefore, every possible adverse condition must be considered. It travels on the highways and across country, it travels in mud and in dry sand. It primarily hauls guns and ammunition, but in practice there is no limit to the uses to which it is put. Had tractors been available to General Pershing on his lines of communication from Columbus, N. M., to Colonia Dublan the air cleaner would have been of immense value. If the air cleaner had been developed and applied to the hundreds of trucks which struggled over this bitter thirty miles, the saving would doubtless have been considerable.

In a well disciplined military organization, cleaners would be given all the attention they require, but we know

Taco "Siphon" Air Cleaner

from experience that with new troops and in times of stress such care cannot be expected. The cleaner for a military tractor, then, will probably be one which requires a little attention—but not much; it is of quite high efficiency—but not necessarily the highest. From an examination of the present developments, it seems very probable that it will be a combination of an inertia type and a dry cloth filter.

Major Lee Otis Wright, U. S. A.

MAJOR LEE OTIS WRIGHT, Ordnance Department, was killed in an airplane accident February 10, 1925, at Brooks Field, Texas, where he was enrolled as a student officer in the Air Service Flying School.

Major Wright was born in Koleen, Indiana, August 6, 1888. He entered the United States Military Academy March 2, 1908, and was graduated June 12, 1912, standing number 7 in a class of 96. After serving three years in the Coast Artillery Corps he was detailed to the Ordnance Department July 14, 1915, where he served continuously until September, 1924, when he was detailed to the Air Service for one year.

Major Lee Otis Wright, U. S. A.

Major Wright was on duty at Rock Island Arsenal from July, 1915, to June, 1916; at Watertown Arsenal from June, 1916, until May, 1917; and thereafter served in the Office of the Chief of Ordnance, Washington, D. C., until June, 1921.

During the War his entire service was as an Ordnance Officer on design and manufacture of small arms and small arms ammunition. He was sent abroad in 1918 with four civilian experts in small arms ammunition manufacture to obtain data on processes of manufacture in use by the Allied Governments in order to assist American manufacturers in meeting the increased demands made upon them. Major Wright brought back a wealth of data on incendiary, explosive, and armor-piercing ammunition, and most valuable information which was of the greatest aid in speeding up production in this country. Early in 1919 he made a second trip abroad.

After the war Major Wright served as Chief of the Aircraft Armament and Small Arms Division of the Technical Staff, Office of the Chief of Ordnance, until June, 1921, when he was detailed to take the course of the Ordnance School conducted at the Massachusetts Institute of Technology. Upon graduation in June, 1922, he was assigned to duty as Chief of the Infantry and Aircraft Armament Division, Mannufacturing Service, Office of the Chief of Ordnance, which position he held until July, 1924.

In September of 1924 he entered on his duties as a student officer at Brooks Field, Texas.

Major Wright was one of the ablest officers of the Department. No officer had a more profound knowledge of his specialty than he. He was an officer of superior intelligence, mentally able to cope with the most abstruse problems of his work, accurate in his conclusions, and forceful and energetic in their application. He never shirked a responsibility—never dodged a decision.

He labored unceasingly to establish a more perfect harmony between the Ordnance Department and the using services of the Line, and to that end collaborated with the Infantry in many of their problems, gaining their confidence and winning their admiration. He urged a more active investigation into the possibilities of semi-automatic shoulder weapons, and he was largely responsible for the fact that several promising types are now under way.

Probably no other single individual is more to be accredited than Major Wright for the rapid progress made in improving small arms and small arms ammunition since the War. Information secured by him abroad has been invaluable, but this, without his vigorous defense of experimental work and his aid in securing appropriations to carry on the work, could not have accomplished what has been done.

He believed that an Ordnance officer could be a better designer, a better manufacturer, more of an expert, if he knew first hand the problems of the using services. He was agreed that an Ordnance Officer could better serve the Air Service if he could regard problems in the light in which Air Service officers saw them.

He had accomplished much in the solution of Infantry small arms problems and with a creditable and unselfish ambition turned to questions confronting the Air Service. Voluntarily he entered a class of student flyers, and, without regard to personal safety, he strove to accomplish what age and physical failings rendered most difficult.

The Ordnance Department has lost one of its most valuable officers, the Line has lost a faithful friend. The Army is deprived of an officer of the highest type in whom was exemplified to a high degree the motto "Duty, Honor, Country." A host of friends has lost a comrade, a true, loyal friend, in whom a trust was never misplaced, by whom a confidence was never violated, and from whom a sympathetic support was never lacking.

S. H. MacGregor,
T. J. Hayes.

Small Arms Abroad

By

BRIG. GEN. JOHN T. THOMPSON

The following address was given before a meeting of the New York Post of the Army Ordnance Association, New York City, January 12, 1925, at which General Thompson presided. This discussion was followed by an illustrated lecture on "Modern Small Arms and Their Uses" by Major Glenn P. Wilhelm, Part I of which appears on page 713 of this issue.

I AM particularly gratified to come here tonight, as it enables me, as one of the "old timers," to express my admiration for the younger generation of Ordnance men.

Successful though this organization may be, I am sure that in your tireless efforts, there must be moments of discouragement in arriving at the ideals for which you strive. I can only remind you of the conditions that confronted the "old timers"—and in particular those of the Small Arms Division—at the commencement of the World War. That story can best be told elsewhere. However, we in the Small Arms Division, perhaps, came out more fortunately than the others.

Such an organization as you are building will undoubtedly save our country the loss of much time and money. It will enhance its chances for victory in future wars, by a percentage I would hesitate to name.

There is, however, another angle to view the participation of the citizen-soldier-engineer in the everyday affairs of the Ordnance Department. The officers of the Ordnance Department, actively engaged in routine duties, do not always have full opportunity to apply the progress of science in relation to armament. Notwithstanding the greatly improved facilities for small arms research work over those of the old times the regular ordnance officers are limited to both available time and money. As a result we must of necessity largely look to other scientific minds—those of our country's engineers, physicists and inventors—for new knowledge upon which to base future developments in small arms. In fact, a review of the past shows that comparatively few military men in any country have been responsible for basic inventions relating to warfare. I say this with no disparagement to that long and honorable list of Ordnance officers who have contributed so much to the honorable record of the Department. I will not name them here—we all know them and take our hats off to them. But it is from you gentlemen sitting here before me, that the basic contributions to this advancement must come. It is from meetings such as this that you can learn of the Ordnance requirements.

I have been requested to give a brief outline of the small arms situation in several European countries, which I have recently visited. The results of my investigations on this subject allow me to be brief. I started out for these countries with a frame of mind resembling Columbus searching for new lands; but my experiences differed considerably from his, in view of the fact that I found nothing new in the way of small arms design.

The military world is now in the midst of a transition period in small arms. However, I believe the principal armed powers, seven years after the war, have learned what type of arms they want for the next step in the history of firearms. Nearly all war offices have come to the conclusion, in so far as small arms are to continue to play an important part in future wars, that automatic arms have the call.

This is a big step. It is a step similar to the jump from the horse driven cab to a motor driven vehicle; but we have not yet reached in automatic arms the days of Rolls Royce design nor of Ford production—these will come in the course of events and will undoubtedly take time. However, this much may be said about the small arms situation in Europe: Nearly every nation in the world is anxiously awaiting a light, portable semi-automatic shoulder rifle. Several years before, on a trip to those countries to show some of our first models and principles, I was struck by the lack of interest in automatic shoulder types. On my recent visit, however, the most striking point to be noted was the intense interest of the war offices in this type of arm, which our own Ordnance Department first proposed and is now bringing to a realization. And we in America, and by "we" I mean all of us who are interested in automatic arms, undoubtedly are leading the world. Other countries are looking to us. I can frankly tell you they have tried and have nothing in the way of a standard, light, portable weapon anywhere.

Another thing I discovered abroad. The consensus of opinion of small arms engineers is that the *limitation of weight* for a semi-automatic shoulder rifle necessitates an operating principle differing from gas or recoil or a combination of the two; because of the *weight inherent* in designs based on these principles. Weight is the predominating factor in automatic shoulder arm design since it affects mobility or the striking power of the infantry mass.

The so-called mitrailleuse has gone out of style and the various types of so-called automatic machine rifles of gas or recoil operation are retained merely in anticipation of *lighter* semi-automatic shoulder types. It is true that such machine rifles are being manufactured, sold and used abroad. But the disadvantages in connection with the use of these makeshifts have been learned in actual warfare, which has proved to the military mind that such heavy types merely served their purpose to fill an emergency. Although these automatic rifles had considerable moral effect they were somewhat over-heralded. They are heavy and cumbersome, weighing 16 to 20 lbs., and by necessity their barrels are so light in comparison with machine guns, that they rapidly heat up and prevent continuous full automatic firing except for an abbreviated period. The heating also in some cases somewhat interferes with the surety of action. In such weapons under 20 lbs. in weight, the recoil, when fired full automatically, is so great as to prohibit accurate use of ammunition when fired at ranges beyond 100 meters. In this country, the firing regulations prohibit full automatic fire beyond 100 yards except for moral effect.

So with the objectives of increasing the accuracy, of saving weight and of economy in the use of ammunition,

the modern small arms engineer has approached the problem of a semi-automatic shoulder rifle from two points of view:

1. By the reduction in the velocity of the cartridge. Such procedure reduces the recoil and also reduces the pressure, enabling more shots to be fired without overheating and allowing of a great reduction in weight. Such weapons are for full automatic fire when in close contact with the enemy. They can accurately fire full automatically to ranges 200 to 300 yards beyond the maximum full automatic range of the high-powered automatic rifles. They also lend themselves readily to marching fire. These weapons, however, are open to the objections of a necessarily much curved trajectory, generally require special ammunition, and merely introduce an additional auxiliary weapon to the infantryman who is already overcome by modern types of war paraphernalia.

2. The second solution of the problem lies in a semi-automatic rifle which fires a high-powered military cartridge. It can now be manufactured within shoulder rifle weights depending upon the barrel used. It can fire as accurately as a Springfield rifle. It fires aimed shots nearly twice as rapidly as the hand-operated infantry rifle; but the use of the semi-automatic shoulder rifle would be justified if only on the plea that it gives *more time to aim*, which is of tremendous advantage to the untrained masses of soldiers making up the huge modern army, and especially at the longer ranges. This rifle can be made cheaply, so to speak, as compared to the machine rifle, and somewhat meets the demands that ammunition will not be wasted. The great considerations in favor of this arm are the *saving in weight, increased accuracy* (especially over machine rifles firing on the forward stroke of the bolt), economy in the use of ammunition and cheap manufacturing costs. This weapon when backed up by the heavy machine gun using modern ammunition, would be sufficient for any army to meet almost any requirement of modern battle tactics.

The automatic small arms field has been, of necessity, a very limited one. It is a most expensive field—and the problems have been so difficult as to discourage both inventors and governments. But I believe that during the present year you gentlemen will have opportunity to observe some developments along these lines that should prove most interesting.

Mr. Weeks, in one of his recent annual reports as Secretary of War, stated that the responsible authorities in the United States were giving their best efforts towards the selection of the next service rifle as a matter of traditional importance. Very recently General Williams, our Chief of Ordnance, made reference to the "self-loader" question during the course of an article on "Modern Ordnance" in November-December, 1924, number of ARMY ORDNANCE. He says, in part: "It is very difficult to produce an entirely satisfactory shoulder arm to meet the rigid requirements of the military service, especially since the weight must be kept practically the same as that of the present magazine rifle. During the World War a great deal of work was done along this line. Several models were made operating on different principles, but none was satisfactory. Since that time the experimental work has continued. Judging from the progress which has already been made, we may be sure that American inventive genius will soon provide us with a highly developed and satisfactory semi-automatic shoulder arm."

I cannot conclude without paying due tribute to the work performed by our District Ordnance Chief, Colonel James L. Walsh. All his activities have been of the unselfish patriotic kind. As you know, ARMY ORDNANCE grew under his tutelage and today it is the foremost ordnance magazine in the world. We all know of his work here in this district since he left the Army.

In conclusion, I wish to pay tribute to the officer whom I am to introduce as the lecturer of the evening—Major Glenn P. Wilhelm, Chief of the Small Arms Division of the War Department at Washington. He revised the rifle range tables, especially those pertaining to the longer ranges. Firing accurately at the longer ranges and at the longest ranges possible with our cartridges—suddenly became during the War of the utmost importance on account of the necessity for barrage fire or fire over the heads of our troops from machine guns. In this work he showed that a considerable part of the work for the longer ranges which had been done in the past was not entirely correct, probably due to the inadequate facilities of the times. He assisted in the development of the U. S. Army rifle cartridge to the stage where it is now practicable to issue to every soldier in this country service ammunition that is equal to what is known as "selected match ammunition." This is a remarkable achievement. It has been carried to success through the modern facilities of the Ordnance Department for research and testing work. In the development of the American Army rifle and cartridges, I feel, not without a great deal of interest in the matter, that Major Wilhelm is not only "holding the fort"—but that he has helped to build up for the American Army the topmost position in such a field in the world today.

Annual Meeting of Raritan Arsenal Association

THE third annual meeting and banquet of the Raritan Arsenal Association will be held in the Butterfly Room on the roof of the Hotel Pennsylvania, New York City, Saturday, April 18, at 7 p. m. All members of the Association are invited to attend.

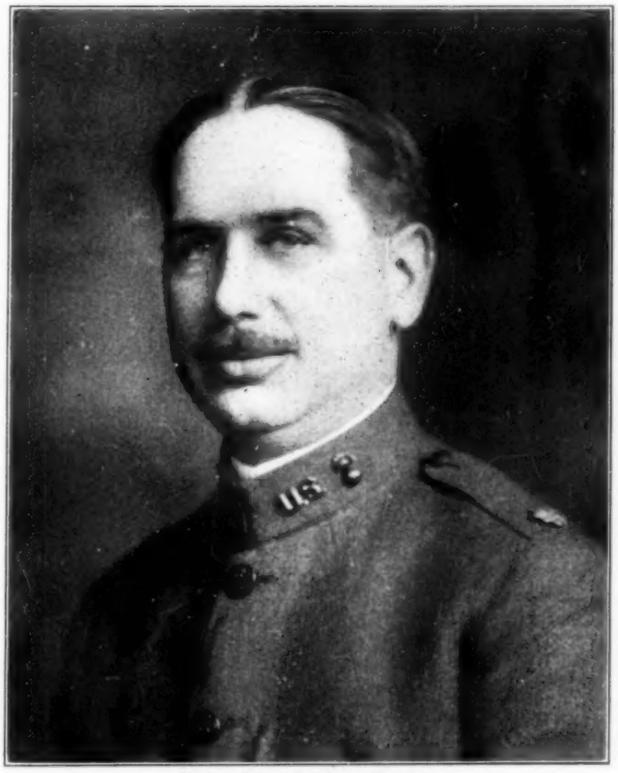
The Raritan Arsenal Association was founded shortly after the World War for the purpose of keeping up the friendships formed by officers and employees who served at Raritan Arsenal. Raritan was one of the largest of the ordnance establishments during the war, and many of the supplies destined for overseas consignment were handled through that depot.

The Association comprises several hundred members and judging from attendance at the past annual meetings most of them will attend this annual reunion. Mr. J. H. M. Andrews is President of the Association, Mr. E. McK. Hunt, Treasurer, and Mr. S. H. Chestnut, Secretary.

All members who anticipate attending should make their arrangements through the Secretary at 1308 Chestnut Street, Philadelphia.

Major John Herbert Hunter, U. S. A.

THE Army Ordnance Association and the Ordnance Department of the Army suffered a second severe loss in the tragic death of Major John Herbert Hunter, Ordnance Department, U. S. A., who was killed in a railway accident at Corregidor Island, P. I., February 20, 1925. The news of Major Hunter's death followed closely upon that of Major Lee Otis Wright, also of the Ordnance Department, who was killed in an airplane crash at Kelly Field, Texas, February 10, 1925.



Major John Herbert Hunter

Major Hunter was one of the best known and most popular officers of the Ordnance Department. Entering the Service in December, 1917, as a Captain, he filled important positions in connection with the development and manufacture of explosives, and became one of the foremost authorities in this field in America. During the War he served in the Explosives Section in the Engineering Division and later became Chief of the same section in the Ammunition Division. In July, 1922, he took up his duties at Picatinny Arsenal where he was in charge of the experimental laboratory. In June, 1923, he began a tour of foreign service with station at Fort Mills, Corregidor Island, Philippine Islands.

The accident in which he lost his life also took as its toll the lives of several other officers and men who were occupants of the trolley. Press dispatches give Major Hunter praise for his heroic effort to save the women and children occupants of the car from injury. As the vehicle got beyond control of the crew and dashed down the long and steep incline leading to the shore, Major Hunter attempted to save the other passengers by standing on the running board and shielding them. Quickly gaining in momentum, the car overturned killing Major Hunter and seven others and wounding a score.

Born at Alliance, Ohio, May 19, 1879, Major Hunter received his education in the public schools of Washington, D. C., and at George Washington University. He first served as assistant chemist at the Albemarle Zinc and Lead Co., and later in the same capacity at the U. S. Smokeless Powder Factory at Indian Head, from 1901 to 1903. He then entered the employ of the Laflen and Rand Powder Company where he remained until 1906. After another period of service at Indian Head he was appointed an assistant chemist and inspector at the U. S. Bureau of Mines where he served from 1910 to 1915. He then became associated with the Western Cartridge Co., as plant superintendent, and in December, 1917, was commissioned a Captain in the Ordnance Department, U. S. A. In October, 1918, he was promoted to the grade of Major.

His varied commercial experience as research chemist and manufacturer of smokeless powder and explosives well equipped him for the conspicuous service he rendered during the World War. Of untiring energy, Major Hunter filled his official assignments with a thoroughness that marked him as one of scientific bearing. Much of the progress in explosives manufacture and storage made by the Ordnance Department during and since the World War is due to his fine spirit of co-operation and his exhaustive knowledge in this field. He was an enthusiastic supporter of all measures looking toward efficient and safe methods of transportation and in this he was of valuable assistance to the Department.

Shortly after the Armistice Major Hunter had the difficult assignment of coordinating the powder and explosive activities of the Department. Due to the gigantic effort put forth by the country in these fields the task of stabilizing development and manufacturing work was extremely important. Here again Major Hunter performed very valuable work for the Department and the country. His familiarity with all stages of explosives development and manufacture brought to this tedious work a knowledge and thoroughness that added greatly to the satisfactory accomplishment of the task.

By his death the Ordnance Department is deprived of the services of an exceptionally efficient officer—a man esteemed by all of his associates. The Army Ordnance Association too must add to its roster of departed members the name of one of its most entnusiastic and kindly supporters—Major John Herbert Hunter.

C. T. HARRIS, JR.

Editorials

Support the National Guard

ELSEWHERE in this issue is published a very comprehensive and enlightening article on The National Guard, by Major General Rickards, Chief of the Militia Bureau of the War Department. It no doubt contains many items of interest which are not generally known even among the most enthusiastic followers of industrial preparedness. The National Guard is one of the more important of the main branches of our national defense, and it should have the unqualified support of everyone.

In this respect a recent official statement by the Chamber of Commerce of the State of Virginia is particularly appropriate. At the annual meeting of that body held in Petersburg, Virginia, on January 22nd, 1925, a resolution was unanimously passed endorsing and advocating the maintenance of a strong and efficient National Guard in that State. The resolution follows:

> "RESOLVED, That it is the sense of the Virginia State Chamber of Commerce that the maintenance of a strong, efficiently organized and adequately equipped National Guard is for the best interests of the Commonwealth and of the Nation and that the business concerns of the State should support the Virginia National Guard by encouraging their employes in enlisting for service therein, and by granting such employes an annual two weeks' vacation with pay covering the field training period."

A strong, properly backed, efficiently administered National Guard is not only a great protective agency of every state, but it is likewise a civic instrumentality of tremendous possibilities. The training of our young manhood for service in defense of our institutions has a very direct relation to every business establishment in every state, and a closer contact between the organized units of the National Guard and local commercial and civic organizations throughout the states will certainly augur well for the best interests of national defense. It is to be hoped that other civic organizations in other states will follow this excellent example of the Chamber of Commerce of Virginia and back the National Guard to the fullest extent.

Colonel Bruce Cornwall

COLONEL BRUCE CORNWALL, Chief of the San Francisco District of the Ordnance Department, has been elected by the California Post of the Army Ordnance Association as a director under the provisions of Article V, Sec. 2, of the Constitution. This section provides that in addition to the six Directors elected by general ballot of the members, one Director is to be elected by each duly authorized Post of the Association.

Colonel Cornwall has been unsparing in his efforts to further the interests of industrial preparedness on the Pacific Coast, and the addition of his name to the roster of Directors of the Association adds additional honor to an already well known group of ardent industrial defense advocates. Colonel Cornwall's term of office will extend to November 30, 1926.

Who's Who In This Issue

IN this issue of ARMY ORDNANCE we are pleased to present a collection of important articles by a number of prominent authors who are well equipped in their respective fields.

The address of Secretary of War Weeks before the graduating class of the Army Industrial College speaks for itself. The Secretary needs no introduction to our readers. A prominent member of the now famous graduating class of the United States Naval Academy of 1881, Secretary Weeks has had a long and honorable record of public service. His administration of the War Department during the past four years has merited for him the praise and enthusiastic support not only of the Army as a whole but of our citizens in general.

Maj. Gen. George C. Rickards, who writes on "The National Guard" is Chief of the Militia Bureau of the War Department. General Rickards began his military career as a Lieutenant Colonel in the 16th Pennsylvania Infantry in May 1898, and since that time has been a conspicuous figure in National Guard circles. For his exceptionally meritorious work during the World War he was awarded the Distinguished Service Medal. His article, we believe, is one of the most important discussions on this very important branch of our national defense that has yet appeared in print.

Major Glenn P. Wilhelm has written an excellent account of "Modern Small Arms and Their Uses," Part 1 of which is published in this issue. Major Wilhelm is Chief of the Infantry and Aircraft Armament Division of the Ordnance Office and is acknowledged to be one of the foremost small arms experts in the country today. He has made signal contributions to the development of our present service types of small arms and small arms ammunition and we believe his discussion to be of vast importance to our readers, small arms enthusiasts and all others.

Major Earl McFarland is Professor of Ordnance and Gunnery at the U. S. Military Academy. He was formerly commanding officer at the Springfield Armory, and his previous experience in the Department added to an already authentic viewpoint concerning the design and manufacture of the Springfield Rifle. His article on "The Manufacture of the Bolt of the Springfield Rifle" is an authentic discussion of an important phase of ordnance production.

Part II of the Annual Report of the Chief of Ordnance for the Fiscal Year 1924 appears in this issue. General Williams thus concludes one of the most informative and creditable accounts yet given of the Ordnance Department. The many activities and the excellent showing made by all establishments is a tribute not only to his superb administration, but to an *esprit* seldom equaled in any organization.

The article on "The Role of Malleable Cast Iron in Ordnance" is the contribution of Lt. Comdr. Alfred G. Zimermann, Chief of the Metallurgical and Testing Division of the U. S. Naval Gun Factory. Commander Zimermann is a valued contributor to our pages. He made special studies in metallography and metallurgy at Harvard.

Major Kenneth B. Harmon who is in charge of tractor development for the Ordnance Department at the plant of the Holt Manufacturing Company at Stockton, Cal., has written an important paper on "Air Clarifiers." Major Harmon has contributed a great many valuable improvements in ordnance automotive design, and is one of the foremost ordnance specialists in this field. His article should have a very important bearing on a topic which is of interest to automotive designers and manufacturers both of military and commercial vehicles.

Index to Army Ordnance, Volume I

THERE is published with this issue of ARMY ORDNANCE an index to Volume I, Nos. 1 to 6, July-August, 1920, to May-June, 1921, inclusive.

Charter members of the Association and old subscribers will recall that an index to Volume I has, until this time, not been published, and in view of the importance of the magazine as a reference book on ordnance and armament subjects, the index, we believe, will be well received.

An index to Volume II has been prepared and will be published in the near future and with it indices for the entire series of the magazine will have been published. In future, indices will be published with the closing number of each volume.

The value of ARMY ORDNANCE as an authentic reference on all current ordnance development and manufacture is continually growing. We urge all members to save their copies and, if possible, bind them for reference use. Ordnance is an ever changing subject and literature on it is very difficult to consult. A casual glance at a bound volume of ARMY ORDNANCE is a surprising revelation both as to the quantity of material covered and the importance of the data discussed.

Citizens' Military Training Camps, 1925

PLANS are now under way throughout the country for the summer season of Citizens' Military Training Camps to be held in accordance with the approved policy of the War Department. Present indications are that the camps will be well filled and, due to the untiring effort of those charged with this duty in the War Department, a continually growing list of applicants for this privileged training period seems in prospect. It is therefore advisable that every one who knows of any youth eligible for this period of training should take steps at once to acquaint him with the necessity of making immediate arrangements.

The advantages of the training afforded by the Citizens' Training Camps are not to be measured in words. General Pershing, addressing last year's class at Plattsburg, said, "There is nothing militaristic about this training; it is entirely voluntary, building first healthy bodies and then minds. This training will enable you to have some conception of the requirements of a country like ours in time of an emergency."

In fostering this excellent spirit and urging full attendance at all the C. M. T. camps, we can do no better than to quote the following comment which appeared in the *New York Times*, of March 13, 1925, concerning the excellent work being done at Plattsburg. What *The Times* says of the Plattsburg Camp applies equally to those which will be held in all sections of the country.

"Even if this generation does not see another war, the fibre of American citizenship will be stronger for voluntary attendance at the training camps. They are schools of manhood and character; instruction in the manual of arms and simple maneuvers are incidental. As the years pass, memories of the military exercises may become dim, but never will the personal associations of Plattsburg be forgotten. Friendships are formed, all that is best in ingenuous youth is fostered. To the end of life Plattsburg is something to talk about with enthusiasm: the democratic spirit of the place, the drills and hikes, the sports of water, field and forest, the historic inspiration, and glorious Lake Champlain, on whose flood the far-stretching peaks of the Green Mountains and the Adirondacks look down. To be a graduate of the Citizens' Military Training Camp is a distinction. Fortunate the young man who can spend one or more vacations there. Four will qualify him for a commission in the Officers' Reserve Corps. There are no finer officers and gentlemen than the instructors at Plattsburg, the flower of West Point, the pick of the Reserve Corps, vying with one another to fashion the candidates from all walks of life into volunteer soldiers and better citizens. Plattsburg has its lecture rooms and church services as well as its drill grounds and rifle ranges. The work of the instructors is not well done unless the improvement of their charges is progressive. Inspector General Helmick of the United States Army made this little speech when he visited Plattsburg last August:

> 'I want you officers to feel that you have not done your duty if at the end of the very first day, and of every day, the boys you have noted as most in need of improvement have not braced up perceptibly, breathing deeper, standing straighter, if they are not gladder of being alive.'

"Last year saw the busiest, the most successful Plattsburg since 1917. Prospects for the summer of 1925 are of the brightest. Congress increased the military training camps appropriation from $2,320,000 to $3,127,471 (the budget estimate). In our Second Corps Area an attendance of 4,700 at the camps is expected. Most of the candidates will be seen at Plattsburg. The Government pays for transportation, uniforms, shelter and food, and provides for recreation in the open and under cover, including concerts, band music and dancing. Instructional duty will be limited to five hours a day. Saturday afternoon and Sunday will be devoted to relaxation and sports. A salient feature of life at Plattsburg is the distribution of awards and medals for soldierly efficiency, marksmanship and excellence in sports. The enrollment this year already promises to exceed that of 1924."

There are four courses available to those who attend the camps. The basic course is open to students between the ages of 17 and 24. Three other courses, designated the "Red," "White" and "Blue," are open to those between the ages of 17 and 25, 18 and 28, and 19 and 31, respectively. Other qualifications for admission to these advance courses depends upon the student's previous military training.

So again we urge every one who is eligible or who knows of others who may be eligible, to help make this year's Citizens' Military Training Camps a huge success.

Reserve Corps Notes

Items of Interest to Members of the Ordnance Department Reserve

Edited by Major John A. Brooks, Jr., Military Personnel Section, Office of the Chief of Ordnance

ORDERS have been issued by the Commanding General, Second Corps Area, directing the following officers of the T. A. Group to report at the Ordnance Specialists' School, Raritan Arsenal, on April 12th for fifteen days training:

Capt. Louis J. Maidhof, Ord. Res., 225 Morris St., Morristown, N. Y.

Capt. Stanley H. Wolcott, Ord. Res., 117 East 59th St., New York City.

Capt. John E. Dixon, Ord. Res., 515 West Seneca St., Ithaca, N. Y.

1st Lt. Robert J. Fee, Ord. Res., 482 East 8th St., Brooklyn, N. Y.

1st Lt. Levi W. Hulley, Ord. Res., Room 1600, 104 Broad St., New York City.

MANY officers who have been recently appointed or re-appointed are wondering why they do not receive their commissions. Pending the adoption of a new form, no commissions were issued by the Adjutant General for several months. Although the new forms have now been received, there are about thirty thousand commissions to be issued. It will probably be several weeks before this work is completed.

ORDERS have recently been issued by the War Department which change the designation of the various branches of the Reserve. The words "Ordnance Department Reserve" have been substituted for "Ordnance Officers' Reserve Corps," and the abbreviation "Ord. Res." is prescribed in place of "Ord. O. R. C."

OFFICERS of the Ordnance Reserve Corps who reside in or near Washington have organized a class for the purpose of receiving instruction in military and ordnance matters. At the first meeting, January 9, 1925, the following officers were elected: Chairman, Lt. Col. Isaac Weil; Vice-Chairman, Major Samuel G. Green; Secretary, Capt. Leo A. Codd; Treasurer, Capt. A. M. Ehrlich.

Meetings are to be held on the second and fourth Mondays of each month from 8:00 to 10:00 P. M. Between 8:00 and 9:00 o'clock an officer on duty with the Organized Reserves gives instruction in those subjects with which every Army officer should be familiar. During the present year, from 9:00 to 10:00 o'clock officers of the Ordnance Office are presenting the various activities of the Department in such a way as to give a general idea of the Ordnance problem and of the manner in which this problem is being solved. Next year the course will include such subjects as elementary Ordnance engineering and a study of the various kinds of matériel. The officers who are taking the course have so many different assignments that specialized instruction is not feasible. Accordingly the course will include only such subjects as *every* Ordnance officer should be familiar with. The average attendance has been about 50. This is about 60 per cent of the officers available.

On January 26th Major D. K. Shurtleff discussed the organization of the Ordnance Department and the progress and scope of war plans.

On February 9th Major J. B. Rose, in charge of the Artillery Division of the Manufacturing Service, gave an interesting illustrated talk on the Artillery Division and the developments in artillery.

On February 23rd, Major B. O. Lewis, in charge of the Tank, Tractor and Trailer Section, Manufacturing Service, entertained as well as instructed the class with an illustrated talk on developments in automotive equipment. He presented two reels of motion pictures which showed various vehicles under test at Aberdeen Proving Ground.

Correspondence Courses

MANY officers have been handicapped in their desire to increase their knowledge of Ordnance matters by the lack of suitable instruction pamphlets or correspondence courses. Pamphlets covering the construction, operation and maintenance of various kinds of matériel are being prepared and published as Training Regulations. Publication has, however, been greatly delayed because of lack of funds.

Based on these Training Regulations and on other War Department publications, correspondence courses are being prepared. Due to the small amount of time available, and the limited personnel for the work, these courses are being rather hurriedly prepared and are to be considered as tentative. They will be used during the year 1925-26, and will then be revised in order to incorporate such changes as appear desirable.

The Basic Course has been prepared for all Ordnance officers of both the T. A. and B. A. Groups. It includes only subjects with which every Ordnance officer should be familiar. The subjects covered by this course will probably constitute part of the examination required for promotion under the new regulations.

The other courses which are being prepared this year are primarily for the use of officers assigned to duty with troops. Later it is contemplated that more advanced courses will be prepared for officers assigned to special service. Descriptions of the various courses follow. These courses will not be available until the fall of this year. They will be given under the jurisdiction of the

Commanding General of the Corps Area in which an officer resides.

BASIC OFFICERS' COURSE:

(a) Scope:

Subjects, susceptible of correspondence methods, which are required of all officers not previously prepared in these subjects.

(b) Duration of the Course:

The subcourses are to be studied in sequence. To complete the Basic Course required approximately 214 hours, of which 98 hours are required of officers not previously prepared in the subjects covered in subcourses 1, 2, 4, 5, and 9.

(c) Program:

Subcourse—	Approximate hours
1. Organization of the Army — Divided into three sections; first, the Army in general; second, the Ordnance Department to show general organization to accomplish its mission; third, organization of Field Service.	18
2. Administration, Discipline and Courtesies — Problems which concern the junior officer, mobilization, rail transportation, company records, individual records of soldiers, company reports, military correspondence, mess management and property responsibility. A brief description of military discipline, courtesies and customs of the service.	26
3. Ordnance Engineering — The fundamentals of Ordnance engineering that should be known by all Ordnance officers.	24
4. Military Hygiene and First Aid — The fundamentals of hygiene and sanitation both personal and as applied to organizations and the general subject of first aid.	10
5. Map Reading — This subcourse is designed to give the officer a working knowledge of map reading and includes horizontal and vertical distances, direction, slopes, visibility, coordinates and conventional signs.	18
6. General Information on Ammunition — General information on ammunition which should be known by all Ordnance officers.	24
7. Property Accounting — Instructions in the regulations on and methods of procedure of property accountability.	24
8. Ordnance Provisioning System — The Ordnance provisioning system, reports required and the necessity of information as to status of stores.	24
9. Military Law — Those principles of military law governing the administration of military justice, with which all officers should be acquainted.	20
10. Commercial Law — The fundamentals of commercial law as applied to leases, contracts, finance, procurement by purchase, etc.	24

COMPANY OFFICERS' COURSE AMMUNITION:

(a) Scope:

Training of all Company officers of Ordnance Company (Ammunition) and of officers assigned to ammunition supply duty.

(b) Duration of Course:

The subcourses are to be studied in sequence. The course requires approximately 200 hours.

(c) Program:

Subcourse—	Approximate hours
1. Ammunition Depot Organization — The organization of and duties at an ammunition depot.	20
2. Ammunition Depot Administration — The administration of an ammunition depot.	20
3. Ordnance Provisioning System — The extension of subcourse 8 of the basic course with special emphasis on ammunition.	20
4. Transportation of Explosives — The regulations for and methods of packing and shipping explosives.	15
5. Storage, Surveillance and Maintenance — The methods of storage, test, surveillance and maintenance of ammunition.	25
6. Demolition — The methods of destroying unserviceable ammunition, duds, etc.	15
7. Ammunition Supply Regulations — The regulations for ammunition supply.	15
8. Supply in the Zone of Interior — The ammunition supply system and methods of ammunition supply in the Zone of the Interior.	10
9. Supply in the Theatre of Operations — The ammunition supply system and methods of ammunition supply in the Theatre of Operations.	10
10. Tactical Employment of Ammunition Companies — The employment of an Ordnance Company (Ammunition) with a tactical unit.	20
11. The Army Corps — Required by officers of Ordnance Company (Ammunition) assigned to corps. Fundamentals of the organization and operation of an Army Corps. (Optional if 11 (a) is taken.)	15
11a. The Field Army — Required by officers of Ordnance Company (Ammunition) assigned to armies. Fundamentals of the organization and operation of an army. (Optional if 11 is taken.)	15

COMPANY OFFICERS' COURSE, DEPOT:

(a) Scope:

Training of all Company officers of Ord-

nance Company (Depot) and of all officers assigned to supply duties.

(b) Duration of Course:

The subcourses are to be studied in sequence. The course requires approximately 130 hours.

(c) Program:

Subcourse—	Approximate hours
1. Depot Organization — The organization of and duties at an Ordnance Depot group system.	20
2. Depot Administration — The duties of administering an Ordnance Depot with specific instruction in storage methods: requisitions.	20
3. Ordnance Provisioning System — Extension of subcourse 8 of Basic Officers Course with special emphasis on general supply articles.	20
4. Supply in the Zone of the Interior — The procedure in supply to the Zone of Interior.	10
5. Supply Regulations — The regulations for supply.	15
6. Supply in the Theatre of Operations — The procedure for supply in the Theatre of Operations.	10
Tactical Employment of an Ordnance Com-	
7. Tactical Employment of an Ordnance Company (Depot) — The employment of an Ordnance Company (Depot) with a tactical unit.	20
8. A Field Army — For officers of Ordnance Companies assigned to an army. Fundamentals of the organization and operation of a field army.	15

COMPANY OFFICERS' COURSE, MAINTENANCE:

(a) Scope:

Training of all Company Officers of Ordnance Company (Maintenance) and of all officers assigned to duties involving supervision of of Maintenance work.

(b) Duration of Course:

The subcourses are to be studied in sequence. The course requires approximately 235 hours.

(c) Program:

Subcourse—	Approximate hours
1. Shop Administration — The functional methods of an Ordnance Company, (Maintenance) reports, administration, organization.	20
2. Methods of Machine Shop Work — Shop methods of an Ordnance Company (Maintenance); equipment; special problems.	20
3. Field Maintenance — The problems of maintenance in the field when shops are not available.	10
4. Maintenance Regulations — The regulations for maintenance.	10
5. Small Arms and Automotive Weapons — General information about the care, storage, maintenance and functioning of small arms and automotive weapons.	40
6. Artillery Matériel — General information as to care, maintenance and functioning of the gun and recoil mechanisms with study of types.	35
7. Artillery Matériel — General information as to the care, maintenance and functioning of the carriage, accompanying vehicles and fire control equipment.	30
8. Automotive Equipment — General instruction in the care and maintenance of trucks, inspections, convoy regulations.	25
9. Tanks and Tractors — Types, functioning, care and maintenance of tanks and tractors.	25
10. Tactical Employment of the Ordnance Company (Maintenance) — Employment of an Ordnance Company (Maintenance)	20

ADVANCE COURSE:

(a) Scope:

Subjects, susceptible of correspondence course methods which are required to prepare an officer for promotion and duty in the grade of major with troops.

(b) Duration of Course:

The subcourses are to be studied in sequence. This course requires approximately 129 hours.

(c) Program:

Subcourse—	Approximate hours
1. Combat Organization — The combat organization of the Theatre of Operations, Division, Corps, Army and G. H. Q. unit, with special relation to staff duty.	24
2. Supply Systems — The systems of supply for all units from company to a field army.	20
3. Combat Orders and Solution of Problems — Combat orders and solution of problems and the methods of solving supply and maintenance problems with Division, Corps and Army.	25
4. The Division and Corps Ordnance Officer — The duties of the Division and Corps Ordnance Officer.	30
5. The Army and G. H. Q. Ordnance Officer — The duties of the Army and G. H. Q. officers and their staffs.	30

Reserve Officers Training Corps

APPROXIMATELY twenty-five per cent of the officers who are being commissioned in the Ordnance Department Reserve are graduates of Ordnance Units of the Reserve Officers Training Corps, or "R. O. T. C.," as it is popularly called. Except for those few officers with war experience who, from time to time, are coming into

the Reserve, the R. O. T. C. is the only source of supply for officers who have had Ordnance instruction and training before they are commissioned. It is also practically the only source of supply for officers who have had military training and experience.

With these facts in mind, one does not have to stretch his imagination to realize the vital importance of the R. O. T. C. to the Ordnance Department. It is an organization which is working under many difficulties. It merits and needs the support of all officers of the Ordnance Department Reserve. On account of the fact that many officers know very little about the R. O. T. C. a very brief account of its organization and activities will be given here. A more complete account will be found in ARMY ORDNANCE for July-August, 1922.

The R. O. T. C. was organized for the purpose of training college students for duty as second lieutenants in the Reserve Corps. Students receive this training at the same time they are securing their college education. The full course requires four years. A student first enrolls for the basic course which requires three hours a week for two years. Upon its completion he may enroll for the advanced course, which requires five hours a week for two years. During the advanced course a student is required to attend one summer camp for a period of six weeks. Upon enrolling in either course, the completion of that course becomes a pre-requisite to graduation. During the advanced course, except for the period of the camp, a student receives thirty cents per day from the Government.

It is desired to draw our R. O. T. C. students only from those courses which give them the basic technical training considered necessary for an Ordnance Reserve Officer. The nature of the engineering curricula at various institutions differs to such an extent that the method prescribed for selecting students is somewhat complicated. A list has been prepared which includes those subjects considered of special value in the basic technical education of an Ordnance officer. Ordnance credit has been assigned to each subject, depending upon its value to the Ordnance Department. A student is required to take enough subjects from this list to total 20 Ordnance credits. This is believed to represent the equivalent of an average engineering course as given at a good technical college. The curricula in mechanical, chemical, electrical, industrial, and, in some cases, other branches of engineering in the institutions which maintain Ordnance Units, is such that this requirement is met without any extra work on the part of a student.

Members of the Ordnance R. O. T. C. Units take the basic course of another unit. This gives them the required basic military training. The advanced course training is partly prescribed and partly elective. Some institutions provide for a very limited number of electives and the prescribed schedule is so severe as to make it impossible for a student to take the full five hours per week of Ordnance instruction during the advanced course. In such cases credit of from one to four hours per week is given for advanced technical courses of Ordnance value, which are taken in addition to those counted for Ordnance credit. At other institutions a number of electives are included in the curricula, and Ordnance courses may be elected. By one or a combination of these two methods, academic credit is granted for R. O. T. C. training. The Ordnance subjects covered during the advanced course include Ordnance engineering, a study of the various types of guns, carriages, and other matériel, Ordnance administration, ammunition, explosives, and other subjects which tend to supplement the students' technical training and make it most adaptable to Ordnance requirements. Many special Ordnance problems are incorporated in the regular engineering courses. This Ordnance instruction is given by an Ordnance officer who is assigned in charge of the Ordnance Unit.

The camp is held at Aberdeen Proving Ground for six weeks beginning about the middle of June. Students usually attend between their Junior and Senior years. Here the instruction is altogether practical. Students are given the opportunity to test all classes of matériel. They learn by actually handling the matériel, firing the guns, repairing and driving the tractors, tanks and other equipment rather than by lecture or demonstration. During the camp they are all given rides in a bombing plane. Students have the opportunity to fire a course on the small arms range, and the majority qualify as marksman, sharpshooter, or expert rifleman. Regular military discipline prevails. However, the work of the day is over at 3:00 P. M. Students are then encouraged to swim or play base ball, tennis, or golf. A dance is held each week. Students are permitted to be away week ends, and many interesting trips can be taken. The instruction is of inestimable value in the education of an Ordnance officer, but this is so interesting and is supplemented by so many forms of recreation that many students call the camp the finest vacation of their lives. All equipment, food, and medical attention are furnished by the Government and a student receives pay at the rate of about 70 cents per day.

If the R. O. T. C. course has been satisfactorily completed and a student has been recommended by the president of the institution and by the military department, he is given a commission as second lieutenant in the Ordnance Department Reserve at the time he graduates from college, or as soon thereafter as he becomes of age.

Ordnance Units of the R. O. T. C. are now maintained at seven colleges and universities. The table herewith gives information regarding the present status of these units and shows the progress which has been made.

The average boy enters college with a fairly definite idea of the subjects he wishes to take, at least during the first semester. He has talked over the matter at home with his parents. When he enters school he is bewildered by all the various activities which he encounters. During the few hours before classifying for his courses, he is not in a position to consider the matter properly and change his election of subjects, even if the R. O. T. C. has been suggested to him. In many cases he knows nothing of the R. O. T. C. until after the semester is under way, and it is then too late to enroll. It is almost essential that a prospective student be interested in the R. O. T. C. before he leaves his home to enter college. Officers of the Reserve Corps can be of great assistance to the Reserve by discussing the R. O. T. C. with prospective students and with their parents.

Ordnance Units of the R. O. T. C.

Unit	Ordnance Officer in Charge	Established	Students Enrolled: Freshmen	Sophomores	Pre-Juniors	Juniors	Seniors	Total	Commissioned: 1921	1922	1923	1924	Total
University of California	Major R. W. Pinger	1923	---	---	---	18	6	24	---	---	---	---	---
University of Cincinnati	Capt. J. A. B. Gibson	1921	---	---	26	24	13	63	---	---	14	10	24
Cornell Unversity	Lt. L. J. Meyns	1920	---	99	---	38	20	157	12	30	17	18	77
Georgia School of Technology	Lt. F. C. Shaffer	1921	---	---	33	78	53	164	---	6	21	33	60
Mass. Inst. of Technology	Major C. H. Bandholtz	1919	---	---	---	25	38	63	15	26	28	19	88
University of Michigan	Capt. L. M. Bricker	1921	16	22	---	13	13	64	---	2	8	13	23
Yale (Discontinued 1924)		1920	---	---	---	10	7	17	2	6	6	6	20
University of Wisconsin	Lieut. R. Z. Crane	1920	19	13	---	9	12	53	1	5	11	9	26
Total			35	134	59	215	162	605	30	75	105	108	318

NOTE: At some institutions students are not enrolled in the Ordnance Unit until they enter their Sophomore, Pre-Junior, or Junior year.

R. O. T. C. NOTES

MANY members of Ordnance Units of the R. O. T. C. have become associate members of the Army Ordnance Association. It is believed that the various activities of other Ordnance Units will be of interest to them. Moreover, it is felt that recent graduates of the R. O. T. C. will continue to take an interest in the Unit from which they graduated.

Arrangements have therefore been made to publish such items of interest to the R. O. T. C. as come to the attention of the Ordnance Office. Such items must, of necessity, be contributed by the various units or by individual members thereof. If you wish to have such matters published, please do your part by sending in anything of interest pertaining to your unit.

M. I. T.—Students of the Ordnance Unit have formed a pistol club which has proved of much interest to those who wish to become familiar with the use of an arm which is part of the equipment of every officer. Membership is open to students from all Units of the R. O. T. C.

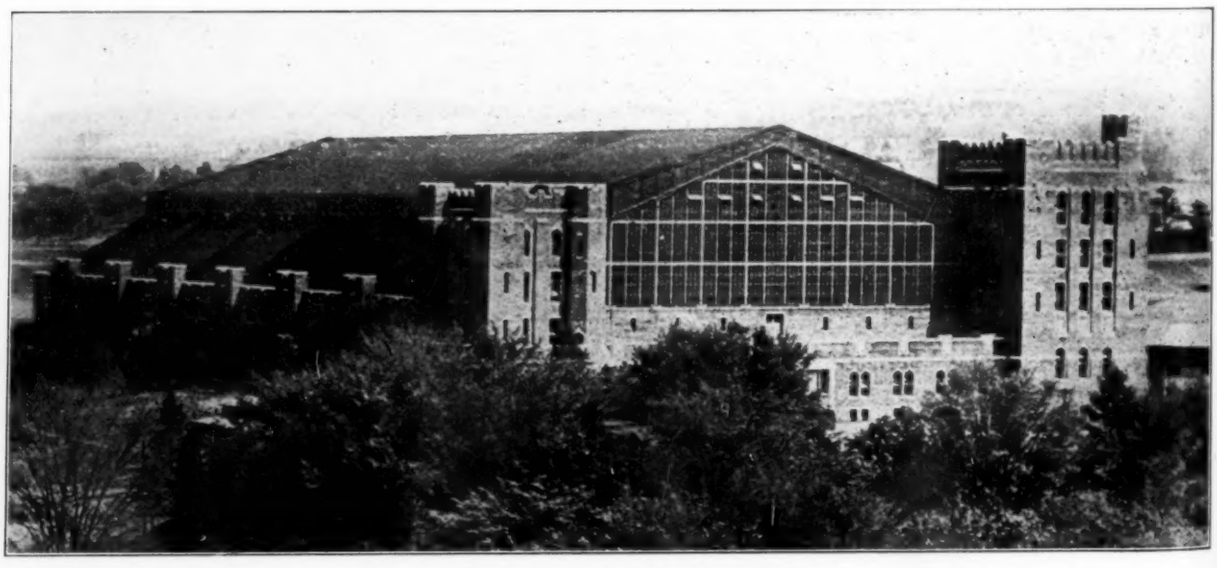
Georgia Tech.—The Ordnance students comprise the fourth battalion of the R. O. T. C. regiment. In an inter-battalion foot-ball series which has recently been completed this battalion took second place.

Cornell.—The Unit at Cornell is particularly fortunate in having the use of an armory which provides every facility required for military instruction. The main floor measures 325 by 560 feet. Besides this there are several class rooms, offices, store rooms, a large locker room and an indoor range.

University of California.—On the evening of February 10, 1925, the Ordnance R. O. T. C. Unit of the University of California staged a very successful demonstration for the benefit of the Cadet Officers' Club at that institution. Although the Unit had been organized little over a year, it was felt, even within the Military Department, that its work, equipment and personnel were more or less shrouded in mystery.

So on that evening, under the leadership of Cadet-Lieutenant Dehmel, a most interesting program was offered. The Ordnance field was divided into four parts—design, production, test and maintenance. Each of these functions was then represented by a selected feature illustrated by lantern slides, actual matériel or by experiment. For example, under "Production," Mr. McCauley exhibited and showed the use of a complete set of 3.8" shrapnel gages. He also explained a large number of production slides.

Mr. Smith had previously made some mercury fulminate and some H. M. T. D. (Hexamethylenetriperoxidediamine). After serving out ear-cotton, he proceeded to



The Armory at Cornell University

illustrate their comparative properties. Mr. Judah (also of the College of Chemistry) demonstrated the manufacture of tetryl and showed bottles containing each intermediate product from benzene to the finished article.

The evening becoming too serious, he exhibited some nitroguanidine which he had previously prepared. He explained that he had incorporated some in the propellant of some blank cartridges. With the lights off, a few ordinary blanks were fired in a machine gun and the flash observed. "Now watch the flashless rounds," he said. At that a concealed confederate started the air hammer of the artillery repair truck. But the joke was really on the Ordnance, for the illusion succeeded too well.

Under "test" Mr. Dixon, assisted by an Aberdeen Chronograph, took the velocity of a caliber .22 pistol. He also demonstrated a caliber .30 pressure gage and with slides showed larger scale work at the Fort Casey Camp last summer.

Cadet-Lieutenant Shriber covered the subject of "maintenance" with a short talk and slides. He then called in his crew, who started the artillery repair truck and ran everything on it simultaneously. When Dehmel had cut out a steel C (for California) with the oxy-acetylene outfit the evening was closed with apple pie a la mode and a general inspection of the Ordnance laboratory, reading room, and apparatus. *(Submitted by Major R. W. Pinger, Ord. Dept., University of California.)*

Recently Reappointed Ordnance Reserve Officers

THE following officers have accepted reappointment in the Ordnance Department Reserve:

Col. James H. M. Andrews, Ord. Res.,
7208 Lincoln Drive, Philadelphia, Pa.
Col. Edgar E. Arison, Ord. Res.,
6337 Winthrop Ave., Chicago, Ill.
Lieut. Col. Charles C. Chase, Ord. Res.,
734 McKnight Bldg., Minneapolis, Minn.
Lieut. Col. Leverett M. Clark, Ord. Res.,
45 East 55th St., New York, N. Y.
Lieut. Col. Claude E. Fitch, Ord. Res.,
1033 Elmwood Ave., Wilmette, Ill.
Lieut. Col. Clarence H. Froelich, Ord. Res.,
1134 New St., Bethlehem, Pa.
Lieut. Col. Gordon F. Hull, Ord. Res.,
5 Parkway, Hanover, N. H.
Lieut. Col. James H. Moffatt, Ord. Res.,
104 West Montgomery Ave., Ardmore, Pa.
Lieut. Col. Fred A. Rogers, Ord. Res.,
Rand Place, Lawrence, L. I., N. Y.
Lieut. Col. Frank J. Stephenson, Ord. Res.,
Royersford, Pa.
Lieut. Col. Isaac Weil, Ord. Res.,
1906 N St. N. W., Washington, D. C.
Major George W. Barr, Ord. Res.,
41 Janvrin Road, Bronxville, N. Y.
Major John H. Barrett, Ord. Res.,
147 Reservoir Ave., Providence, R. I.
Major George R. Brothers, Ord. Res.,
827 Beverly Ave., Bethlehem, Pa.
Major William L. Browning, Ord. Res.,
3300 Newark St. N. W., Washington, D. C.
Major Paul D. Chandler, Ord. Res.,
208 West 8th St., Los Angeles, Calif.
Major Robert Cockburn, Ord. Res.,
Watervliet Arsenal, Watervliet, N. Y.
Major Bernard L. Eaton, Ord. Res.,
Richmond & Norris Sts., Philadelphia, Pa.
Major Everett J. Ellis, Ord. Res.,
7651 Fountain Ave., Hollywood, Calif.
Major Ralph I. Graves, Ord. Res.,
1200 16th St. N. W., Washington, D. C.
Major Henry B. Hallowell, Ord. Res.,
care of R. E. Littlefield, R. F. D. No. 1,
Kennebunk, Me.
Major Charles F. Hunter, Ord. Res.,
Box 445, Sound Beach, Conn.
Major George E. Knable, Ord. Res.,
5305 St. James Terrace, Pittsburgh, Pa.
Major Roy R. Knox, Ord. Res.,
314 East Madison St., Portland, Ore.
Major Claire G. Landes, Ord. Res.,
176 Webster Park Ave., Columbus, Ohio.
Major John H. Nead, Ord. Res.,
603 Stanley St., Middletown, Ohio.
Major Lionel G. Nightingale, Ord. Res.,
Kings Court, Poughkeepsie, N. Y.
Major Raymond A. O'Neill, Ord. Res.,
Walker Road & Valley Road, West Orange, N. J.
Major True B. Rife, Ord. Res.,
311 North 2nd St., Independence, Kans.
Major George R. Roe, Ord. Res.,
196 E. Main St., Patchogue, N. Y.
Major George Schuster, Ord. Res.,
Room 3702 Munitions Bldg., Washington, D. C.
Major Annesley D. Smith, Ord. Res.,
26 Chester St., Mt. Vernon, N. Y.
Major Zeliffe P. Smith, Ord. Res.,
Southern Railway Bldg.,
1300 Pennsylvania Ave., Washington, D. C.
Major Stephen S. Thorn, Ord. Res.,
47 East 34th St., New York, N. Y.
Major Richard R. Vincent, Ord. Res.,
45 West 60th St., New York, N. Y.
Major Lee E. Walker, Ord. Res.,
524 E. Tulpehocken St.,
Germantown, Philadelphia, Pa.
Major Charles F. Wieland, Ord. Res.,
2831 Garber St., Berkeley, Calif.
Capt. Paul Anderson, Ord. Res.,
1735 New Hampshire Ave. N. W., Washington, D. C.
Capt. McFarland Benham, Ord. Res.,
802 Spink Arms, Indianapolis, Ind.
Capt. George I. Boles, Ord. Res.,
St. Davids, Pa.
Capt. John J. Burling, Ord. Res.,
Brookside, N. J.
Capt. Philip B. Campbell, Ord. Res.,
1977 Biltmore St. N. W., Washington, D. C.
Capt. Leon Commerford, Ord. Res.,
1831 Ontario Place, N. W., Washington, D. C.
Capt. Frank J. Connors, Ord. Res.,
716 Tacoma Ave., Buffalo, N. Y.
Capt. Ceylon C. Corkran, Ord. Res.,
734 W. 8th St., Salt Lake City, Utah.
Capt. Abraham B. Cox, Ord. Res.,
Cherry Valley, N. Y.
Capt. Monroe Curtis, Ord. Res.,
Hastings-on-Hudson, N. Y.
Capt. Robert I. Daley, Ord. Res.,
411 Real Estate Trust Bldg., Philadelphia, Pa.
Capt. Richard S. Dougan, Ord. Res.,
Berrien Springs, Mich.
Capt. Andrew Duncan, Ord. Res.,
Fort Preble, So. Portland, Me.

Capt. Henry N. Eversole, Ord. Res.,
7239 Lindell Blvd., St. Louis, Mo.
Capt. Charles A. Finley, Ord. Res.,
5814 N. Park Ave., Philadelphia, Pa.
Capt. Wallace S. Fowler, Ord. Res.,
117 Florence St., Roslindale, Mass.
Capt. James A. Gibb, Ord. Res.,
Wailuku Maui, H. T.
Capt. Clarence A. D. Glentworth, Ord. Res.,
Box 65, Manchester, Mass.
Capt. Aaron E. Gowrie, Ord. Res.,
74 Wilmont St., Springfield, Mass.
Capt. Frank R. Gray, Ord. Res.,
16344 Thatford Ave., Howard Beach, N. Y.
Capt. Harry S. Hall, Ord. Res.,
3013 N. Keating Ave., Chicago, Ill.
Capt. Carl E. Hellenberg, Ord. Res.,
231 California Ave., Detroit, Mich.
Capt. John O. Hillis, Ord. Res.,
1171 Tanglewood St., Memphis, Tenn.
Capt. Ernest Hippe, Ord. Res.,
Hq. 4th Corps Area, Atlanta, Ga.
Capt. Milton G. Holton, Ord. Res.,
4845 Emerson Ave., South Minneapolis, Minn.
Capt. Claude W. Keefer, Ord. Res.,
3216 Guilford Ave., Baltimore, Md.
Capt. Harry L. Koenig, Ord. Res.,
care of John Wood Mfg. Co., Conshohocken, Pa.
Capt. Oliver M. Leath, Ord. Res.,
705 Park Ave., Attica, Ind.
Capt. Christopher L. LeVien, Ord. Res.,
160 Wadsworth Ave., New York, N. Y.
Capt. Samuel J. Lewis, Ord. Res.,
Army Reserve Depot, New Cumberland, Pa.
Capt. Wilfred G. MacCarthy, Ord. Res.,
P. O. Box 234, Lawrence, Mass.
Capt. Frederick V. Maurer, Ord. Res.,
Supply Co. 49th Infantry, Ft. Snelling, Minn.
Capt. Floyd E. Mehrhof, Ord. Res.,
309 Grant Ave., New Brunswick, N. J.
Capt. Thomas Y. Milburn, Ord. Res.,
908 Vickers Ave., Durham, N. C.
Capt. Henry B. Morrison, Ord. Res.,
2500 Emerson Ave., S. Minneapolis, Minn.
Capt. Ralph G. Nichols, Ord. Res.,
10720 112th St., Richmond Hill, L. I., N. Y.
Capt. George M. Orf, Ord. Res.,
744 Fishers Ave., Philadelphia, Pa.
Capt. Clifford H. Peters, Ord. Res.,
112 South View Ave., Atlanta, Ga.
Capt. Harry F. Plank, Ord. Res.,
2023 Chateau St., Pittsburgh, Pa.
Capt. Paul Potter, Ord. Res.,
1879 Charles Road, East Cleveland, Ohio.
Capt. Walter C. Prichard, Ord. Res.,
1806 Blake St., Berkely, Calif.
Capt. James A. Reid, Ord. Res.,
520 New Britain Ave., Hartford, Conn.
Capt. Harry E. Rubin, Ord. Res.,
3760 Carter Ave., Detroit, Mich.
Capt. Reuben J. Smith, Ord. Res.,
Hotel Browning, Grand Rapids, Mich.
Capt. Weldon D. Smith, Ord. Res.,
887 Amherst St., Buffalo, N. Y.
Capt. Fred G. Stewart, Ord. Res.,
P. O. Box 539, Manila, P. I.
Capt. Edward L. Sullivan, Ord. Res.,
227 White St., Waverley, Mass.
Capt. Clarence W. Thomas, Ord. Res.,
65 Lathrop Ave., Binghamton, N. Y.
Capt. Carroll P. Thweatt, Ord. Res.,
202 E. 32nd St., Baltimore, Md.
Capt. George H. Trautman, Ord. Res.,
421 Clinton St., Milwaukee, Wis.
Capt. Richard C. Waterman, Jr., Ord. Res.,
143 Clinton St., Redwood City, Calif.
Capt. Henry J. Welch, Ord. Res.,
129 Warren St., Arlington, Mass.
Capt. Ralph E. Westervelt, Ord. Res.,
P. O. Box 164, Tenafly, N. J.
Capt. Samuel Wiley, Ord. Res.,
Hotel Dover, Dover, N. J.
Capt. Alonzo F. Woodside, Ord. Res.,
31 Lebanon St., Winchester, Mass.
Capt. William R. Wright, Ord. Res.,
208 South LaSalle St., Chicago, Ill.
Capt. Nelson A. Zeiger, Ord. Res.,
92 Washington St., Newark, N. J.
1st Lieut. Herbert M. Bennett, Ord. Res.,
1432 Carlos Ave., Burlingame, Calif.
1st Lieut. Ernest V. K. Bowne, Ord. Res.,
165 Liberty St., Newburgh, N. Y.
1st Lieut. John L. Brown, Ord. Res.,
54 Sanhican Drive, Trenton, N. J.
1st Lieut. Bert W. Carter, Ord. Res.,
care of The Chile Exploration Co.,
Chuquicamata, Chile, S. A.
1st Lieut. Stanley H. Ellison, Ord. Res.,
1140 Woodyerest Ave., Mt. Vernon, N. Y.
1st Lieut. Clay M. Fooks, Ord. Res.,
411 E. Lafayette Ave., Baltimore, Md.
1st Lieut. Samuel M. Foust, Ord. Res.,
Pedro Miguel, Canal Zone.
1st Lieut. Charles M. Haines, Ord. Res.,
2822 Lee St., Greenville, Tex.
1st Lieut Cyrus F. Jennings, Ord. Res.,
763 West Mark St., Winona, Minn.
1st Lieut. Frank W. Kelsey, Ord. Res.,
114 Major St., Woodlawn, Pa.
1st Lieut. Frederic P. Kirschner, Ord. Res.,
6570 Sheridan Rd., Chicago, Ill.
1st Lieut. Newton Mattis, Ord. Res.,
Hawaiian Dept., Fort Ruger, H. T.
1st Lieut. Frank A. Sass, Ord. Res.,
Manlius, N. Y.
1st Lieut. William H. W. Skerrett, Ord. Res.,
1065 Seyburn Ave., Detroit, Mich.
1st Lieut. Carl Trometre, Ord. Res.,
1423 Girard St. N. E., Washington, D. C.
1st Lieut George W. Ridgway, Ord. Res.,
P. O. Box 278, Reno, Nevada.
1st Lieut. Cecil P. Robinson, Ord. Res.,
62 Egmont St., Brookline, Mass.
1st Lieut. Samuel S. Scott, Ord. Res.,
1010 Pine St., Darby, Pa.
1st Lieut. Harry Smith, Ord. Res.,
Field Artillery School, Fort Sill, Okla.
1st Lieut. Walter H. Stewart, Ord. Res.,
5008 Pacific Ave., Detroit, Mich.
1st. Lieut. Charles T. Stiles, Ord. Res.,
337 Kenmore Rd., Brookline, Pa.
1st Lieut. Carl Y. Tengwald, Ord. Res.,
Hotel Holland, Medford, Ore.
1st Lieut. Cecil E. Watts, Ord. Res.,
132 9th Ave., So. Charleston, W. Va.

2nd Lieut. Arlington B. C. Deppe, Ord. Res., Fort Eustis, Va.
2nd Lieut. Hupp R. Douglass, Ord. Res., 461 West Second St., Lexington, Ky.
2nd Lieut. Charles J. Gibbs, Ord. Res., Morton Ave., Morton, Pa.
2nd Lieut. Alexander J. McConnell, Ord. Res., 609 No. 18th St., Philadelphia, Pa.
2nd Lieut. Earl P. Reebel, Ord. Res., 60 W. La Clede Ave., Youngstown, Ohio.
2nd Lieut. James H. Rowe, Ord. Res., 1146 Aldrich Ave., So. Minneapolis, Minn.
2nd Lieut. Gustav A. Weston, Ord. Res., 21 Central Ave., Baldwin, N. Y.

Recently Assigned Ordnance Reserve Officers

THE following reserve officers have recently been assigned as indicated after their names:

Col. William W. Coleman, Ord. Res., General Office, Executive Section, Washington, D. C.
Col. Frank A. Scott, Ord. Res., Manufacturing Service, Cleveland Dist. Ord. Office, Cleveland, Ohio.
Lieut. Col. Franklin B. Richards, Ord. Res., Manufacturing Service, Executive Section, Washington, D. C.
Lieut. Col. Arthur B. Roberts, Ord. Res., Manufacturing Service, Cleveland District Ordnance Office, Cleveland, Ohio.
Lieut. Col. Frederick M. Waterbury, Ord. Res., Territorial Assignment Group.
Major James B. Arthur, Ord. Res., Manufacturing Service, Boston District Ordnance Office, Boston, Mass.
Major Albert K. Chapman, Ord. Res., Manufacturing Service, Buffalo District Ordnance Office, Watervliet, N. Y.
Major Stanley W. Cook, Ord. Res., Manufacturing Service, Bridgeport Dist. Ord. Office, Springfield, Mass.
Major Louis A. Daerr, Ord. Res., Manufacturing Service, Chicago Dist. Ord. Office, Chicago, Ill.
Major James B. Fitzgerald, Ord. Res., Manufacturing Service, Chicago Dist. Ord. Office, Chicago, Ill.
Major Robert W. Gardner, Ord. Res., Manufacturing Service, New York District Ord. Office, New York, N.Y.
Major Isaac S. Hall, Ord. Res., Mfg. Service, Boston Dist. Ord. Office, Boston, Mass.
Major George H. Higgins, Ord. Res., Mfg. Service, Rock Island Arsenal, Rock Island, Ill.
Major William H. Keen, Ord. Res., Manufacturing Service, Buffalo District Ordnance Office, Watervliet, N. Y.
Major Arthur E. Merkel, Ord. Res., Manufacturing Service, Cleveland District Ordnance Office, Cleveland, Ohio.
Major Frederick J. Root, Ord. Res., Manufacturing Service, New York District Ordnance Office, New York. N. Y.
Major Walter S. Schneider, Ord. Res., Manufacturing Service, New York District Ordnance Office, New York, N. Y.
Major Elmer E. Snare, Ord. Res., Manufacturing Service, Chicago District Ordnance Office, Chicago, Ill.
Major William C. Swift, Ord. Res., Manufacturing Service, Boston District Ordnance Office, Boston, Mass.
Major William P. Turner, Ord. Res., Manufacturing Service, Chicago District Ordnance Office, Chicago, Ill.
Capt. Ephraim J. Almquist, Ord. Res., Manufacturing Service, Artillery Division, Washington, D. C.
Capt. Earl R. Baird, Ord. Res., Territorial Assignment Group.
Capt. George R. Bowman, Ord. Res., Territorial Assignment Group.
Capt. James F. Brown, Ord. Res., Territorial Assignment Group.
Capt. Jay S. Buckley, Ord. Res., Manufacturing Service, Bridgeport District Ordnance Office, Bridgeport, Conn.
Capt. Manly A. Collins, Ord. Res., Field Service, Charleston Ord. Res. Depot, Charleston, S. C.
Capt. Arundel Cotter, Ord. Res., Manufacturing Service, New York District Ordnance Office, New York, N. Y.
Capt. J. Leroy Delany, Ord. Res., Manufacturing Service, Artillery Division, Washington, D. C.
Capt. Rudolph H. Fox, Ord. Res., Manufacturing Service, St. Louis District Ordnance Office, St. Louis, Mo.
Capt. Walter Graham, Ord. Res., Manufacturing Service, St. Louis District Ordnance Office, St. Louis, Mo.
Capt. Paul J. Guinther, Ord. Res., Manufacturing Service, Pittsburgh District Ordnance Office, Pittsburgh, Pa.
Capt. Warren B. Hood, Ord. Res., Manufacturing Service, Philadelphia District Ordnance Office, Philadelphia, Pa.
Capt. Arthur C. Jones, Ord. Res., Territorial Assignment Group.
Capt. Paul L. Lambert, Ord. Res., Territorial Assignment Group.
Capt. Ralph G. Macy, Ord. Res., Territorial Assignment Group.
Capt. Philip O. Potts, Ord. Res., Manufacturing Service, Detroit District Ordnance Office, Detroit, Mich.
Capt. Henry S. Rade, Ord. Res., Manufacturing Service, Springfield Armory, Springfield, Mass.
Capt. Ralph C. Shaw, Ord. Res., 1724 Montpelier Ave., Dormont, Pa.
Capt. Charles G. Spice, Ord. Res., Manufacturing Service, Bridgeport District Ordnance Office, Springfield Armory, Springfield, Mass.
Capt. Allen C. Staley, Ord. Res., Manufacturing Service, Tank, Tractor & Trailer Division, Washington, D. C.
Capt. Kenneth I. Tredwell, Ord. Res., Manufacturing Service, New York District Ordnance Office, New York, N. Y.
Capt. William J. Williams, Ord. Res., Manufacturing Service, New York District Ordnance Office, New York, N. Y.
1st Lieut. Thomas W. Bell, Ord. Res., Field Service, Pig Point Ordnance Reserve Depot, Portsmouth, Va.
1st Lieut. Leo A. Bryson, Ord. Res., Manufacturing Service, New York District Ordnance Office, New York, N. Y.
1st Lieut. Newton O. Clemenson, Ord. Res., Territorial Assignment Group.
1st Lieut. Donald G. Cockcroft, Ord. Res., Manufacturing Service, New York District Ordnance Office, New York, N. Y.
1st Lieut. Lawrence J. Corsa, Ord. Res., Manufacturing Service, New York District Ordnance Office, New York, N. Y.
1st Lieut. Donald W. Cronkite, Ord. Res., Territorial Assignment Group.
1st Lieut. Abraham M. Ehrlich, Ord. Res., Technical Staff, Washington, D. C.
1st Lieut. Walter H. Free, Ord. Res., Manufacturing Service Artillery Division, Washington, D. C.
1st Lieut. Harry A. Hirsch, Ord. Res., Manufacturing Service, Philadelphia District Ordnance Office, Philadelphia, Pa.
1st Lieut. William H. Hunt, Jr., Ord. Res., Territorial Assignment Group.

1st Lieut. Austin L. Kimball, Ord. Res., Territorial Assignment Group.
1st Lieut. Joseph A. Llompart, Ord. Res., Administration Division, Finance Contact Section, Washington, D. C.
1st Lieut. Lamar Polk, Ord. Res., Territorial Assignment Group.
1st Lieut. Vergil C. Pritchett, Ord. Res., Manufacturing Service, New York District Ordnance Office, New York, N. Y.
1st Lieut. George B. Ruden, Ord. Res., Manufacturing Service, New York District Ordnance Office, New York, N. Y.
1st Lieut. Carl W. Vail, Ord. Res., Territorial Assignment Group.
2nd Lieut. James E. Duffy, Jr., Ord. Res., Territorial Assignment Group.
2nd Lieut. Lewis W. Dunbar, Ord. Res., Territorial Assignment Group.
2nd Lieut. Egny G. Dvileskis, Ord. Res., Territorial Assignment Group.
2nd Lieut. Arthur W. Epperson, Ord. Res., Territorial Assignment Group.
2nd Lieut. Earl F. Flanagan, Ord. Res., Territorial Assignment Group.
2nd Lieut. Albert S. Martin, Ord. Res., Territorial Assignment Group.
2nd Lieut. Harvard A. Morehad, Ord. Res., Territorial Assignment Group.
2nd Lieut. Chester Mueller, Ord. Res., Manufacturing Service, New York District Ordnance Office, New York, N. Y.
2nd Lieut. Louis M. Pace, Ord. Res., Territorial Assignment Group.
2nd Lieut. Herbert P. Schowalter, Ord. Res., Territorial Assignment Group.
2nd Lieut. Mark A. Stephenson, Ord. Res., Territorial Assignment Group.
2nd Lieut. Robert B. Taylor, Ord. Res., Manufacturing Service, Ammunition Division, Washington, D. C.
2nd Lieut. Gordon A. Walter, Ord. Res., Territorial Assignment Group.
2nd Lieut. Benjamin E. Watkins, Ord. Res., Manufacturing Service, Birmingham District Ordnance Office, Birmingham, Ala.
2nd Lieut. Carl H. Weaver, Ord. Res., Territorial Assignment Group.

Recently Commissioned Ordnance Reserve Officers

THE following have accepted reserve commissions since last issue of ARMY ORDNANCE:

Col. Ledyard Cogswell, Jr., Ord. Res.,
69 State St., Albany, N. Y.
Col. William W. Coleman, Ord. Res.,
care of Bucyrus Co., So. Milwaukee, Wis.
Col. Bruce Cornwall, Ord. Res.,
2301 Pacific Ave., San Francisco, Calif.
Col. Frank A. Scott, Ord. Res.,
"Chesterfield," Mentor, Ohio.
Lieut. Col. Theodore J. Hoover, Ord. Res.,
Stanford University, Calif.
Lieut. Col. Gilbert P. McNiff, Ord. Res.,
1609 Beechwood Blvd., Pittsburgh, Pa.
Lieut. Col. Franklin B. Richards, Ord. Res.,
1300 Leader News Bldg., Cleveland, Ohio.
Lieut. Col. Arthur B. Roberts, Ord. Res.,
622 Swetland Bldg., Cleveland, Ohio.
Lieut. Col. Frederick M. Waterbury, Ord. Res.,
116 Onslow Place, Kew Gardens, L. I., N. Y.
Major James B. Arthur, Ord. Res.,
21 Hosmer St., Watertown, Mass.
Major Lindsley M. Brown, Jr., Ord. Res.,
3721 Travis Ave., Fort Worth, Tex.
Major Stanley W. Cook, Ord. Res.,
Northampton St., Holyoke, Mass.
Major Almon W. Copley, Ord. Res.,
1205 Drake Ave., Burlingame, Calif.
Major Don H. Foster, Ord. Res.,
2400 16th St. N. W., Washington, D. C.
Major Robert W. Gardner, Ord. Res.,
34 Ward Ave., Tompkinsville, Staten Island, N. Y.
Major Isaac S. Hall, Ord. Res.,
72 Woburn St., West Medford, Mass.
Major George H. Higgins, Ord. Res.,
Burd High Compression Ring Co.,
Rockford, Ill.
Major Frederick D. McLaughlin, Ord. Res.,
2129 Renrock Rd., Cleveland Heights, Ohio.
Major Arthur E. Merkel, Ord. Res.,
1888 Wymore Ave., East Cleveland, Ohio.
Major Frank L. Peterson, Ord. Res.,
131 Hillcrest Place, Peoria, Ill.
Major Frederick J. Root, Ord. Res.,
111 Kenilworth Place, Ridgewood, N. J.
Major Walter S. Schneider, Ord. Res.,
472 West End Ave., New York, N. Y.
Major Elmer E. Snare, Ord. Res.,
8021 Constance Ave., Chicago, Ill.
Major William C. Swift, Ord. Res.,
2 Clinton St., Cambridge, Mass.
Capt. Ephraim J. Almquist, Ord. Res.,
1825 Vernon St. N. W., Washington, D. C.
Capt. Earl R. Baird, Ord. Res.,
1608 Jackson St., Sioux City, Iowa.
Capt. Walter C. Bender, Ord. Res.,
care of Chief Engineer's Office,
Northwestern Bell Telephone Co.
Omaha, Nebr.
Capt. George R. Bowman, Ord. Res.,
92 Middle St., Laconia, N. H.
Capt. James F. Brown, Ord. Res.,
430 Marion St., Denver, Colo.
Capt. Manly A. Collins, Ord. Res.,
2620 Forbes St., Jacksonville, Fla.
Capt. Arundel Cotter, Ord. Res.,
99 Claremont Ave, New York, N. Y.
Capt. Paul A. Curtis, Jr., Ord. Res.,
8806 Parsons Blvd., Jamaica, N. Y.
Capt. Walter H. Damon, Ord. Res.,
6739 Cornell Ave., Chicago, Ill.
Capt. J. Leroy Delany, Ord. Res.,
439 Newton Place, N. W., Washington, D. C.
Capt. Hally Fox, Ord. Res.,
A. & M. College, Miss.
Capt. Paul J. Guinther, Ord. Res.,
1527 Asbury Pl., Pittsburgh, Pa.
Capt. Warren B. Hood, Ord. Res.,
1158 Marlyn Road, Philadelphia, Pa.
Capt. Arthur F. Hubbard, Ord. Res.,
Elkton, Md.
Capt. Arthur C. Jones, Ord. Res.,
South Pittsburgh, Tenn.
Capt. Paul L. Lambert, Ord. Res.,
care of Adjutant General's Office,
Phoenix, Ariz.
Capt. Harold K. McCook, Ord. Res.,
Apt. 33, 2116 P St. N. W., Washington, D. C.

Capt. Ralph G. Macy, Ord. Res.,
45 E. 55th St., New York, N. Y.
Capt. William M. Moody, Ord. Res.,
2929 19th St., San Francisco, Calif.
Capt. Philip O. Potts, Ord. Res.,
708 Arch St., Ann Arbor, Mich.
Capt. Henry S. Rade, Ord. Res.,
70 Morningside Drive, New York, N. Y.
Capt. Barrett Rogers, Ord. Res.,
510 Lake St., Oak Park, Ill.
Capt. Ralph C. Shaw, Ord. Res.,
1724 Montpelier Ave., Dormont, Pa.
Capt. Austin D. Smith, Ord. Res.,
106 N. Van Dien Ave., Ridgewood, N. J.
Capt. Kenneth I. Tredwell, Ord. Res.,
149 Clove Rd., New Rochelle, N. Y.
Capt. William J. Williams, Ord. Res.,
36 Wendt Ave., Larchmont, N. Y.
1st Lieut. Leo A. Bryson, Ord. Res.,
3569 Broadway, New York, N. Y.
1st Lieut. Newton O. Clemenson, Ord. Res.,
Mt. Pleasant, Utah.
1st Lieut. Donald G. Cockeroft, Ord. Res.,
15 Dey St., New York, N. Y.
1st Lieut. Lawrence J. Corsa, Ord. Res.,
4020 Ferris St., Woodhaven, N. Y.
1st Lieut. Donald W. Cronkite, Ord. Res.,
1601 So. 33rd St., St. Joseph, Mo.
1st Lieut. Abraham M. Ehrlich, Ord. Res.,
3325 11th St. N. W., Washington, D. C.
1st Lieut. Walter H. Free, Ord. Res.,
51 W. 48th St., New York, N. Y.
1st Lieut. William H. Hunt, Ord. Res.,
319 Post Office Bldg., San Francisco, Calif.
1st Lieut. Claude S. Kegerreis, Ord. Res.,
Purdue University, Lafayette, Ind.
1st Lieut. Austin L. Kimball, Ord. Res.,
246 Court Ave., Memphis, Tenn.
1st Lieut. Joseph A. Llompart, Ord. Res.,
119 Rittenhouse St., Washington, D. C.
1st Lieut. Lamar Polk, Ord. Res.,
205 Commercial Bank Bldg., Alexandria, La.
1st Lieut. George B. Ruden, Ord. Res.,
48 Orchard St., Jamaica, L. I., N. Y.
1st Lieut. Carl W. Vail, Ord. Res.,
470 Franklin Ave., Ridgewood, N. J.
2nd Lieut. Earnest V. Antrobus, Ord. Res.,
Hq. 9th Corps Area, Presidio of San Francisco, Calif.
2nd Lieut. James E. Duffy, Jr., Ord. Res.,
1611 Center St., Bay City, Mich.
2nd Lieut. Lewis W. Dunbar, Ord. Res.,
West Main St., Richmond, Ky
2nd Lieut. Egny G. Dvileskis, Ord. Res.,
19 Buckingham St., Waterbury, Conn.
2nd Lieut. Arthur W. Epperson, Ord. Res.,
915 1-2 W. Franklin St., Evansville, Ind.
2nd Lieut. Earl F. Flanagan, Ord. Res.,
220 Colorado St., Huron, S. Dak.
2nd Lieut. Charles B. Janes, Ord. Res.,
140 Carlton Road, Waban, Mass.
2nd Lieut. George G. Jones, Ord. Res.,
223 Riverside Drive, Apt. No. 2, South,
New York, N. Y.
2nd Lieut. Frederick B. McNeil, Ord. Res.,
care of 1st National Bank, Durango, Colo.
2nd Lieut. Albert S. Martin, Ord. Res.,
1313 Brown St., Mobile, Ala.
2nd Lieut. Harvard A. Morehead, Ord. Res.,
Fort Scott, Kans.
2nd Lieut. Chester Mueller, Ord. Res.,
147 Pomona Ave., Newark, N. J.
2nd Lieut. Louis M. Pace, Ord. Res.,
Wilburton, Okla.
2nd Lieut. Ernest F. Page, Ord. Res.,
4685 N. 16th St., Philadelphia, Pa.
2nd Lieut. John Rowston, Ord. Res.,
Charleston Ordnance Reserve Depot,
Charleston, S. C.
2nd Lieut. Herbert P. Schowalter, Ord. Res.,
407 S. 6th Ave, West Bend, Wis.
2nd Lieut. Orion O. Smith, Ord. Res.,
1232 North Church St., Rockford, Ill.
2nd Lieut. Mark A. Stephenson, Ord. Res.,
R. F. D. No. 1, Decatur, Ga.
2nd Lieut. Robert B. Taylor, Ord. Res.,
1587 Lewis Drive, Lakewood, Ohio.
2nd Lieut. Gordon A. Walter, Ord. Res.,
1344 Palmer St., Philadelphia, Pa.
2nd Lieut. Carl H. Weaver, Ord. Res.,
637 Kayton Ave., San Antonio, Texas.

Lieut. Whitehead, Ordnance Reserve, and Brother Missing

SECOND LIEUT. JOSEPH H. WHITEHEAD, Ord. Res., and his brother, William A., have been missing since August 24, 1924. They are the sons of Mrs. Dora B. Whitehead, and live with their mother and sister at 3040 Warren Avenue, Chicago, Ill.

The brothers left Chicago on August 15, 1924, for a two weeks' vacation in Glacier National Park, Montana, and had enjoyed one week of it when they mysteriously disappeared. On Sunday morning, August 24th, they left Granite Park Chalets for a 19-mile hike to the Lewis Hotel where they had a reservation for the night. They were not seen at the hotel. Their trail was a well traveled one, in a valley most of the way, and free from precipices or other hazards. The last six miles of the trail is an auto road that leads to Belton, Montana, or to Canada. Two hikers answering the description of the boys were seen at noon just eight miles from the Lewis Hotel, or two miles from the automobile road.

Rewards totalling $1,700.00 have been offered for information leading to the whereabouts of the brothers.

Descriptions of the brothers when last seen follow:

Joseph H. Whitehead—Age, 29; Height, 5 ft. 11 in.; Weight, 175 lbs.; Gray eyes; Dark brown hair; Ruddy complexion; Wore glasses with dark rims.

William A. Whitehead—Age, 22; Height, 5 ft. 11½ in.; Weight, 155 lbs.; Brown eyes; Dark brown hair; Dark complexion; Wore glasses with dark rims.

Both wore hiking clothes, gray knickers, gray wool shirts, high tan laced hiking shoes, soft felt hats. Carried light packs. Both wore sweaters: one gray, the other tan.

ARMY ORDNANCE will gladly forward to the family any information concerning the whereabouts of these young men.

Professional Notes

AMMUNITION DIVISION

Bombing the U. S. S. Washington

THE following extracts from the Report of the Navy General Board describe the recent tests of armor-piercing projectiles and bombs upon the super-dreadnaught Washington:

"The latest bombing experiment was conducted by the Navy, and the uncompleted battleship Washington was employed as the target. Strictly speaking, the Washington was not a target, but a hull embodying the latest ideas of underwater construction upon which was measured the destructive effect of both torpedo and bomb explosions, by actually placing the explosive charges at such points of submergence as would test the resistance of the hull.

"Beginning in December, 1910, the navy had conducted a careful series of experiments extending over several years in which it was sought to determine the best form of underwater construction and hull subdivision to minimize the result of torpedo and mine explosions. Small-scale models of a half-section of a ship were tested by a reduced charge exploded under water and the results checked up occasionally with a full-scale section using full torpedo charge. The results of the investigations were embodied in the design of our latest battleships, and finally, the Washington afforded an opportunity to test the efficacy of the adopted scheme on an actual battleship.

"For the purposes of test the ship was ballasted to draw twenty-five and a half feet and all watertight subdivisions were completed up to the third deck. This deck, which was about five feet above the waterline, was not watertight between frames 57 and 103, a distance of 184 feet. The deck-plating over both engine rooms was not in place and was only bolted down over the motor room. The third deck was open to all boiler rooms, motor rooms and machinery spaces. Air-port openings were blanked. Both main condensers were installed.

"Five bombs were exploded; three of these contained 1,000 pounds of explosive each and were detonated under water at the most effective depths and at distances from the ship's side well within the zone surrounding the ship which had heretofore been claimed as an area in which similar explosions would destroy a ship. Two charges, each amounting to the largest now carried by torpedoes, were detonated in contact with the hull, thirteen feet below the waterline.

"The following is a summary of the report setting forth the damage sustained by the ship after being subjected to all five explosions.

"After Test No. 1 (2,000-pound underwater bomb) the ship assumed a list to starboard of about 1½ degrees. Outboard explosion spaces and double bottom spaces were flooded. Inner bottom was bulged but in no place ruptured. Leaks in inner bottom could have readily been stopped by pine plugs and wedges.

"No damage was noted above third deck. There would have been no loss of life, except possibly by men being washed overboard by water thrown on weather deck by the explosion.

"After Test No. 2 (2,000-pound underwater bomb) the damage was similar to that caused by No. 1, but less severe and less in extent; probably more damage to ship's side, but less to bottom. List increased to 2½ degrees.

"In engine room a bulkhead casting was broken. Front brickwork in Boilers 5 and 7 was broken down. This brickwork is not anchored. Main condensers not affected.

"Test No. 3 (400-pound torpedo charge). During the night the list had increased. After third test list was found to be about 5 degrees.

"Damage—Two outboard explosion spaces flooded and one explosion space between longitudinal torpedo Bulkheads 3 and 4 also flooded. Some front brick work of Boilers 2, 4, 6 and 8 came down. This probably was cumulative from other explosions. No apparent damage of third deck or above.

"For some reason this did not appear to be a first order explosion.

"Test 4 (400-Pound Torpedo Charge)—List reduced from 5 to 3 degrees. Five torpedo explosion spaces in wake of explosion were flooded. Double bottoms between Frames 80 and 97 also flooded. Slight leak in Boiler Room 8 from double bottom and from butt in outboard bulkhead where rivets had torn through. All could have been stopped by plugs and wedges and without these could readily have been handled by a bilge pump. All front brick work in Boilers 4 and 6 came down. In no case did any side or back brick work come down.

"Test 5 (2,000-Pound Underwater Bomb)—The most violent of the bomb tests. Ship increased her list to starboard from 3 to 5 degrees. Damage similar to that caused by No. 1, but more severe and more extensive. Inner bottom nowhere completely ruptured.

"After all five tests members of the board were able to get to inner bottom of ship and make all inspections necessary or desired.

"At the end of these five explosive tests, and after riding out a gale of wind for three days, the ship could have been towed to port.

"Had a repair party, immediately after each explosion, used wooden plugs and wedges to stop minor leaks, the ship without the use of pumps, would have remained practically on an even keel. A ship in commission would have had no trouble in making port under her own steam after the five explosions.

"There would have been few injuries and practically no loss of life, except from water thrown on weather decks by the explosions.

"Loss of oil and water, water mixing with oil and oils seeping through weeping seams and rivets would have been serious annoyances. The ship withstood satisfactorily the five explosions. Had there been time be-

tween explosions, the ship could have continued in the battle line at reduced speed. The general jar to the structure might throw gyro compasses and fire control gear out of gear, but I doubt it, if they are placed well away from the ends of the ship. The vibration at the end of the ship from the first explosion did not put out candles nor throw them down when stuck to the deck."

"A test of the ability of the protective decks to keep out armor-piercing missiles dropped from airplanes was made. A fourteen-inch shell weighing 1,440 pounds was dropped from a height of 4,000 feet point downward on the thick armored deck. It failed to penetrate the deck, but the result of the impact showed that such projectiles dropped from heights quite within those attainable by airplanes would have gone through. This danger to a battleship must be met by thicker decks. It should be noted that, notwithstanding the low ceiling at which the projectile was dropped, one plane made eight attempts to deliver its blow and finally dropped a bomb which missed, the other plane made three aiming flights, then dropped a bomb on the fourth and made a hit.

"After suffering the explosion of three underwater bombs of the largest size and two torpedo explosions also of the largest size directly against the hull, with no repair of leaks and no pumps going, the Washington remained afloat four days and was finally sunk by fourteen hits of fourteen-inch shell fired at very oblique impacts to obtain data with respect to penetration of armor. The ship sunk two and three-quarter hours from the time the guns opened fire.

"The question of the impairment of the machinery of a ship by the shock of similar explosions was considered by the board that conducted the test. When the firewalls of the boilers were anchored in the customary manner, they withstood the shock. The condensers with their hundreds of tube joints appeared to be unharmed.

' Much has been said in the public prints of the defeat of the battleship by the submarine. It was the opinion of the members of the board that a ship built like the Washington would survive eight torpedo hits distributed about the underwater body. If they were bunched together she could not withstand them; such a concurrence is hardly within the bounds of possibility.

"The results of the tests demonstrate that the hull of the latest type of battleship is capable of withstanding to a remarkable degree the attacks of aerial bombs, and that with a crew on board to make necessary repairs, run the pumps and man the antiaircraft guns such a ship as the Washington would be substantially secure against air attack.

"The Chief of the Army Air Service has proposed to double the weight of the bomb as a means of turning the scale the other way; that is, to drop bombs weighing 4,000 pounds instead of the heaviest practical ones of today, namely, those of 2,000 pounds weight. This proposed solution of the difficulty requires analysis. As a matter of established fact, doubling the explosive charge only increases its pressure effect by forty per cent. instead of 100 per cent., as might be supposed. Moreover, the bombers of today using a supercharger, can attain a ceiling of only 8,000 feet when carrying a 2,000-pound bomb.

"If the bomb is doubled in weight, the maximum ceiling or height attainable must again be reduced to one in which the bomber is very apt to come to grief from antiaircraft fire. The total weight of bombs plus gasoline that can be carried by the bomber amounts to 4,000 pounds, and any increase of the weight of the bomb above 2,000 pounds must reduce the amount of gasoline that can be carried by the amount of such increase. If the increase is material in amount, the radius of the bomber, already meagre, will be curtailed to such an extent as to seriously hamper its activities. In order to avoid this contingency, the bomber must be entirely remodeled to a larger scale. This is a new and big problem, a solution of which may or may not be found."

Regarding the bombing of the former German cruiser Frankfort off Cape Charles in 1921, the report states that the salient feature of that experiment was that "this lightly built cruiser of only 5,000 tons, with thin decks and thin armor, lying at anchor in clear, fine weather, undefended and unrepaired, survived over seven and a half hours before receiving her death blow from aircraft flying over her at heights of 1,500 to 2,000 feet, far beneath what they would have dared to attempt in war, namely, 10,000 feet."

Citing the bombing of the former German destroyer G 102 off Cape Charles in 1921, the report says that " even the frail structure of a torpedo vessel has a very good chance when attacked by aircraft, although this chance will be lessened as bombing accuracy increases."

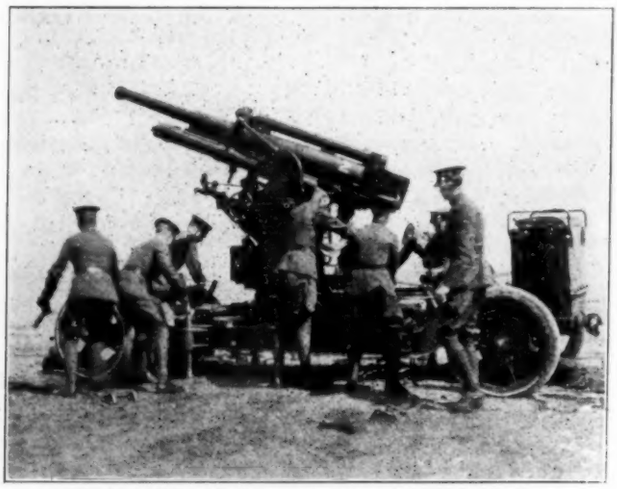
ARTILLERY DIVISION

Air Service and Antiaircraft Exercises at Langley Field and Fort Monroe March 6, 1925

DURING the recent Congressional discussions relative to the offensive power of aircraft and the effect of antiaircraft gun fire, an invitation was extended to the members of the several Congressional Committees concerned to witness an actual demonstration of these two elements of the military power of the United States. As a result a joint demonstration was organized by the Coast Artillery Corps and the Air Service of the Army and was executed with much success at Langley Field and Fort Monroe in spite of the fact that the Congressional attendance was slim and that the weather conditions were not altogether favorable. On the date preceding the event, weather conditions were such that the Army and Navy Officers starting for the demonstration feared the exercises would be nullified by stormy weather and prohibited by poor visibility. However, the morning of Friday, March 6, 1925, brought with it a somewhat clearer atmosphere and a cold and high wind which, although it interfered to some extent by its force, nevertheless aided by dispelling the mists and thus improving the visibility.

Most of the visitors arrived at Fort Monroe by the 7 o'clock boat from Washington, were met by an escort from the 12th Coast Artillery and after breakfast were driven to Langley Field where, at about 10 o'clock the Air Service program commenced. There was first an opportunity for inspection of the planes assembled which included the Martin bombers, DH planes, etc., stationed at Langley Field; planes from Phillips Field, Aberdeen Proving Ground, equipped with smoke screen apparatus and a flight of 12 fast Curtiss pursuit planes of recent construction which arrived at Langley Field late the preceding day from Georgia, enroute to their home station, Selfridge Field. The planes of this latter group were of particular interest to all the visitors, by reason of their speed and of the fact that they were pointed out as the only planes present which embodied the improvements of recent times. Criticisms were heard, however, of their military value, due to the location of the vulnerable radiators within the upper wings.

After the inspection the Air force carried out a simulated attack upon a battleship, using as a target a silhouette, about 600 ft. x 100 ft., marked out by white target cloth upon the ground some half mile from the observation point. First a flight of the single seater pursuit planes gathered over the target and performed



3-inch Antiaircraft Gun and Crew Going into Action

evolutions to represent a clearing of the air of enemy pursuit. Then a very successful smoke screen was laid down for the purpose of obscuring the vision of the personnel of the presumptive target. The high wind dispersed this screen in about a minute. Next the pursuit planes launched an attack upon the target by their machine gun fire delivered while diving directly at the target and by dropping 25-lb. fragmentation bombs at the termination of their dive about 100 ft. to 200 ft. above the surface. The enemy's antiaircraft apparatus and all exposed armament being presumptively put out of action by such preparation, the attack continued by a flight of eight heavy bombers each carrying 15 100-lb. demolition bombs. Three of these ships dropped their bombs upon the simulated target. Fully charged bombs could not be there exploded without danger to the spectators, so these bombs were given only enough charge to show their point of impact. The other five planes dropped their 75 bombs fully loaded in a salvo upon a point more distant, producing a very spectacular burst.

This entire demonstration was impressive to the spectators, carried out as it was without a hitch or accident in spite of the great number of airplanes maneuvering at high speed and close together in a very high wind which was practically a gale. After some further inspection of Air Service appliances, mainly bomb sights, etc., the visitors returned to Fort Monroe and after lunch were driven about four miles up the river to Grand View where, for safety, the antiaircraft firing was to take place. First a battery of 2 3-inch antiaircraft guns, Model 1918, on trailer mounts with an experimental stereoscopic height finder, the RA (Model 1917) corrector, etc., fired 39 rounds of shrapnel at a sleeve target towed by a Martin bomber. This target is a hollow sleeve of cotton cloth about 19½-ft. long, open at both ends; the rear end being about 3½-ft. diameter and the front end about 5-ft. diameter, being held open by a hoop. This target made its first run parallel to the battery and against the wind at an altitude of about 5,000 ft. The speed of this target was not great as the high wind detracted considerably from the moderate speed which a bomber can make with the additional drag of the heavy target. During this run the bursts of the projectiles appeared to lie fairly close to the target and official plotting located three of them within such a distance of the target that the latter should technically have been considered as in danger; nevertheless, neither in this run nor any of the subsequent flights, did any of the fragments of any of the projectiles pierce the target. On the three subsequent runs, the target was much more difficult to attack since here the high wind speed was added to the speed of the bomber and the target raced through the permissible firing zone at about 125 miles per hour. Added to this, the target straightened out on its course at a very short distance to windward of the battery and therefore there was almost no time for adjustment of fire preparatory to the few rounds that could be fired before the target passed the range at which it could be fired upon without danger.

A glider target intended to be fired upon was duly and successfully released by a Martin bomber, but the wind quickly carried it away against a similarly colored background so that it was never seen by the artillerists or by the spectators.

A group of cal. .30 and cal. .50 machine guns then fired a number of bursts upon a sleeve target towed rapidly down wind,—and as far as could be judged by observation of the tracer bullets, laid their fire closely to the target, although but one hit was actually made. Later these same machine guns attacked a number of small rubber balloons turned loose at a point to windward of the guns and as they were blown rapidly past by the high wind, succeeded in demolishing all but one.

In the evening there was a demonstration of the use of searchlights in detecting airplanes and of the use by the planes of flares, etc., for hampering ground observation and for assisting observation from and movements in the air.

The visitors, among whom were numbered many general officers of the Army and flag officers of the Navy, were all greatly interested in these trials and expressed the warmest appreciation of the courtesies and hospitalities extended to them by the garrisons. Especial appreciation was generally expressed for the hospitality of the Officers Mess at Fort Monroe which entertained all the visitors at breakfast and lunch.

Status of Heavy Mobile Artillery (Wheeled)

THE missions of the heavy artillery are special, such as counter-battery, interdiction, and destruction mainly at long ranges which fall beyond the activities or capabilities of the medium (corps) artillery.

It is a part of the G.H.Q. Reserve artillery, which was organized during the World War as Army Artillery. There is also in the G.H.Q. Reserve additional light and medium artillery as well as special purpose material, such as pack artillery, trench artillery, railway guns, super-guns and howitzers, and antiaircraft artillery. These guns are ordinarily classed under their particular type, such as light, pack, etc., and will not be discussed here.

Previous to the World War there was no heavy mobile artillery in our service, such as the heavy artillery of the Army used during the war. The requirements for heavy mobile artillery during the war led to the adoption of types listed on page 759.

	Elevation Degrees	Traverse Degrees	Range Yards	Weight in Firing Position Pounds
Guns				
6-inch Gun, Mk. VIIIA (British)	38	8	19650	22512
155-mm. Gun, M. 1918 G.P.F.	35	60	17160	25960
Howitzers				
8-inch Howitzer, Mk. VII	50	8	10760	20050
9.2-inch Howitzer, Mk. II	50	60	10060	35500
240-mm. Howitzer, M. 1918 (Schneider)	60	20	14280	41296

Of the guns mentioned the 155-mm. G.P.F. gun, M. 1918, was the preferred type used in our service. This unit was regarded as very satisfactory, except for its range, which is somewhat short of that desired for heavy artillery. The carriage is of the split trail type providing a wide field of fire without shifting the carriage. In order to change from the traveling to the firing position, it is necessary to jack up the carriage and secure the axle to the bottom carriage by a pin in order to remove the load from the spring. Separate jacks and a lifting beam are also required to lift the carriage in rear so that the trails may be swung out to their position and attached to the spades which are already approximately in place. The recoil mechanism is of the hydro-pneumatic type with a variable length of recoil. In transporting the unit the gun is retracted to a traveling position, so as to equalize the load on the wheels, and the unit remains a single four-wheel load.

The 6-inch gun is mounted on the same carriage as the 8-inch howitzer. The units available were considered best for use as howitzers, however, so that very few of the 6-inch guns were used.

Of the howitzers available the British 8-inch and the Schneider 240-mm. were the preferred types, and at present in our service the 240-mm. is the preferred of the two. A very few 9.2-inch howitzers were in use during the War, and are retained as a part of our reserve now.

The 8-inch howitzer carriage is a single trail material, permitting a very limited traverse. It has a hydropneumatic recoil mechanism which is a modified Schneider type with a variable length of recoil. The material is transported as a single load on the road; the howitzer is not retracted for traveling. The range of the howitzer, 10,760 yards, is short.

The 240-mm. howitzer carriage is a mobile platform mount which is transported in four loads. These are carried on transport vehicles and assembled at the firing point into the platform mount. Several hours are required for emplacing the unit in firing position under the average conditions which exist in war.

As a result of the experience gained during the World War, it was decided that a type of heavy field gun and a type of heavy field howitzer are necessary for the armament of the field army. The gun should have a range of about 25,000 yards and the howitzer a range of about 18,000 yards, both with a wide field of fire. These pieces which are more powerful than the medium artillery add range for interdiction and harassing, and to the counter-battery and destructive effect of the medium (corps) artillery.

The calibers chosen for future development were 155-mm. for the gun and 8-inch for the howitzer. The 155-mm. projectile is sufficiently heavy for the harassing and interdiction fire which is the principal mission of the heavy gun. This caliber gave general satisfaction during the War, and was used by the principal nations engaged in the war. The 8-inch caliber for the howitzer was chosen as giving the greatest power that could be obtained in a howitzer and yet have the mobility of the 155-mm. gun.

A still heavier type of howitzer and a larger gun having the maximum power consistent with the necessary mobility to accompany an army in the field are considered necessary also, but no work has been done on these, due to lack of funds. The 240-mm. howitzer is regarded as a satisfactory caliber for such a howitzer, the range to be greater than 16,000 yards, preferably near 25,000 yards. An 8-inch gun is regarded as satisfactory for the gun to have a range of 35,000 yards.

Model of 1920 Materiel

To meet the requirement for the normal heavy (army) gun and howitzer, the 155-mm. gun—8-inch howitzer matériel, Model of 1920 was designed, and one field carriage and one self-propelled unit built for test. The piston rod pull for the howitzer is nearly the same as that for the gun, so that no major compromises were necessary to mount the howitzer and the gun on the same carriage. The carriage is of the split trail type generally similar to the 155-mm. G. P. F. used during the war. The matériel in firing position weighs 23,590 lbs. The gun has a range of 25,860 yds. using a 95-lb. projectile with a muzzle velocity of 2,800 f. s. The howitzer has a range of 18,700 yds. using a 200-lb. projectile with a muzzle velocity of 1,950 f. s. The normal charge with a velocity of 2,100 f. s. for the gun at 45 degrees elevation gives a range of 20,000 yards. This range is obtained with the supercharge (muzzle velocity 2,800 f. s.) when firing at 20 degrees elevation. The powder charge for the howitzer is zoned so as to get plunging fire at all ranges up to the maximum.

The recoil mechanism has a variable length of recoil in order to avoid digging more of a firing pit than necessary. The recoil mechanism is adjusted at an arsenal for either the gun or howitzer, and is issued for use only with the cannon for which adjusted. So as to further reduce the depth of pit required, the trunnions are located near the breech. The tipping parts are not balanced about the trunnions then, and a counterpoise is required in order that the piece may be easily elevated and depressed. The lower ends of the two equilibrators rest in brackets on the top carriage and work against arms on the trunnions. The handwheel loads for elevating vary from 2 lbs. to 20 lbs., as compared with the handwheel load of 7 lbs. required to traverse the piece.

A quick return mechanism is provided to return the gun to horizontal for loading. This mechanism is independent of the elevating mechanism so that the laying of the gunner is not disturbed by loading. Jacks are included in the mounting of the axle so that the weight can be taken from the springs and the axle connected directly to the bottom carriage without the use of separate jacks. The method of supporting the trails when going into firing position by the use of a lifting beam and jacks under the rear edge of the bottom carriage, similar to that used with the 155-mm. G. P. F. has proved to be the most practicable in Ordnance Department tests. As the

steel spades provided with the carriage weigh 790 lbs. each, and are not easily handled by hand, a crane carrying a chain block has been mounted on a 10-ton tractor to facilitate their handling. This crane has also been successfully used to swing the trails out to the firing position. One experimental wood spade with metal trail fastenings has been provided in an effort to develop lighter spades and which may more readily be carried on the carriage.

The gun or howitzer may be transported on the carriage in a retracted position. As the total weight, 28,000 lbs., in this position is too great for handling, a division into two loads is more desirable, and the heavy transport wagon is provided to carry either the gun or the howitzer. The wagon is provided with winches for raising the trails underneath the wagon, so as to align the body with the guides of the recoil mechanism and for the retracting of the cannon. As it was found difficult to align the body and the guides by this method alone, the front traveling lock was made adjustable. This adjustment is sufficient to permit the guides of the recoil mechanism to be aligned with the guides on the wagon body and to prevent binding as the center of gravity of the gun moves onto the wagon.

The tests of this matériel made by the Ordnance Department have shown it to be generally satisfactory for a weapon of this type. The matériel is now at Fort Bragg undergoing test by the Field Artillery Board.

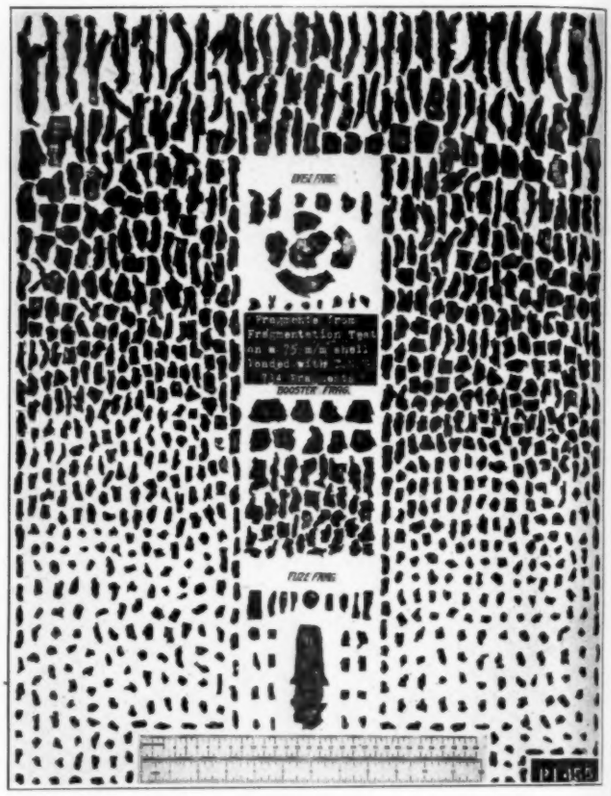
PICATINNY ARSENAL

The Fragmentation Test

THE brisance of an explosive is one of the most important of the several properties to be considered in judging its suitability for any specific purpose. The term "brisance," as commonly used, refers to the capacity of an explosive to shatter the medium which confines it. Since this property is really a resultant of several factors such as velocity of detonation, quantity of gas and amount of heat evolved per unit weight of the explosive, etc., it has been extremely difficult to develop an accurate method for determining or measuring brisance. The velocity of detonation can be measured quite accurately by more or less standard methods, and with explosives which do not differ greatly in the quantity of gas or amount of heat which they evolve upon detonation, this measurement will give a reliable indication of brisance. But in the case of explosives which vary widely in rate of detonation, and in quantity of gas and amount of heat given off, it is necessary to determine each factor separately before a judgment can be reached as to the brisance of the explosives in question. As a matter of fact with these measurements available there is no definite means of combining them to give a definite figure or index which may be said to represent the comparative brisance of any given explosive.

Berthelot in his studies of explosive compounds attempted to establish an index for the power of explosives and introduced his "characteristic product" as a result of these studies. He determined the volume of the gases produced by the explosion of 1 kilogram of explosive and designated this value V_o; he also determined the heat evolved from the explosion of 1 kilogram of explosive and represented this value by Q. The product V_oQ was called the characteristic product of the explosive. It is apparent that this constant can refer only to power and gives no indication of brisance, which is dependent upon velocity of detonation as well as upon the characteristic product.

If sufficient data on a wide variety of explosive compounds were available it might be found that a constant could be developed from the values obtained in rate of detonation determinations and in determinations of the



734 Fragments from Fragmentation Test of 75-mm. Shell Loaded with TNT

characteristic product, which would represent satisfactorily the brisance of explosives. That this is not a simple procedure however, can be readily ascertained if consideration is given to these values as already recorded for a few explosives, in the literature. It has been found that detonating compounds such as mercury fulminate and the azides show brisance out of all proportion to their rate of detonation and their characteristic product; hence the belief is held by some that such detonating compounds are governed by somewhat different laws than the common high explosives.

From the above it is apparent that there is need for a practical test that will enable the comparative brisance of explosives to be judged, if not actually expressed as a physical constant.

From a military standpoint, the fragmentation test is undoubtedly the most satisfactory test for brisance. This test, as carried out at Picatinny Arsenal, enables the explosive to display its strength or brisance, in the actual ammunition component in which it is intended for use. Thus, grenade powders are tested in the standard grenade body, booster explosives in the standard booster casing, and shell fillers in the particular type of shell in which the filler is proposed for use. The test involves merely the assembling of the loaded component, and the firing of it statically in a chamber filled with sand. The sand overcomes the initial momentum of the fragments before they can strike the walls of the chamber, thus enabling the fragments to be collected, by screening the sand, in the same physical shape and size which they possessed

when first produced upon the shattering of the metal body by the detonation of the explosive. The total number of fragments produced by different explosives when tested in the same type of metal component is an accurate indication of the relative brisance of the compounds. For example, the brisance of TNT, Explosive D and 80/20 Amatol has been determined at the Arsenal by loading a series of 75-mm. steel shells with each explosive at the same loading density, i. e., 1.39 ± 01. The average total number of fragments obtained from the series of shell was 630 for Explosive D, 660 for 80-20 Amatol and 725 for TNT. These figures show the order in which these three explosives stand when compared as to brisance.

Another feature of the fragmentation test and one of much practical value, is that by collecting and photographing the fragments a very definite idea of the efficiency of any particular type of shell can be obtained. Assistance can be given in this by grading the fragments as to size and thus determining the number of "effective fragments" that are produced in a given case, effective fragments being understood to comprise those which are of such size that they can be expected to serve the purpose required of them in military operations. There are of course a large number of very small fragments which because of their small mass have insufficient momentum to carry them any appreciable distance. Such fragments can render little embarrassment to the enemy and are therefore considered ineffective. It is apparent then that the most desirable explosive for any given shell, grenade, or other component which is to be employed against troops is one which will give the greatest number of effective fragments. The fragmentation test is the only test that can be applied to accurately determine this point.

G. C. HALE.

SPRINGFIELD ARMORY

Instruction of Student Officers in Repetitive Manufacture

INSTRUCTION of student officers from the Ordnance School at Watertown Arsenal in that portion of Course II which covers Repetitive Manufacture began at the Springfield Armory on February 9, 1925.

For the purpose of this instruction, the class is divided into two groups. Instruction in the first group, consisting of five officers, began on February 9th, and that of the second group, consisting of six officers, began on March 2, 1925. Each group receives 104 hours, or 13 days' instruction, which is distributed as follows:

Milling operations	12 hours
Operations on automatic machines	16 hours
Profiling operations	8 hours
Shaving operations	4 hours
Barrel boring and reaming	8 hours
Barrel rifling	8 hours
Drop forging (actual work)	8 hours
Operations in stocking shop	4 hours
Inspection and gaging	16 hours
Study of jigs and fixtures	4 hours
Browning, bluing, parkerizing and finishing processes	16 hours
Total	104 hours

During this portion of the course the student officer himself actually performs the work on the components beginning with the forging operations and carrying them through the various subsequent machining operations, his work being subject to the same inspection and gaging as that of the civilian employees on regular manufacture.

The course being followed here in repetitive manufacture was instituted last year on the recommendation of the Commandant of the Ordnance School and the Faculty Board at Watertown Arsenal and with the approval of the Chief of Ordnance.

H. W. SCHULL,
Col., Ordnance Dept., Commanding.

Selfloading Shoulder Rifle

UP TO AND throughout the World War the hand operated magazine shoulder rifle has been the principal weapon of the Infantry soldier and it remains the principal weapon today.

The Springfield Rifle, Model of 1903, may be considered the type "par excellence" of this shoulder arm, and is believed to be the best military rifle in the world today.

All nations, including our own, recognized even before the World War, however, that the fire power of the Infantry could be greatly increased, perhaps doubled, if a satisfactory self-loading shoulder rifle could be designed to replace the present hand operated rifle.

The fire arms designers of all countries have accordingly been busily engaged for a number of years endeavoring to overcome the difficulties inherent in the design of a selfloading military rifle, but heretofore, so far as known, no entirely satisfactory model has been developed and adopted by any foreign army.

The Ordnance Department of our Army has been very active along these lines and before the war several models of the selfloading rifle were designed and tested. These earlier types were for the most part too complicated in their construction and too heavy for adoption to replace the present shoulder rifle.

Work to overcome these difficulties has, however, been unremitting. Each year the specifications desired by the Ordnance Department for the selfloading type of weapon have been sent to all interested American designers and competitive tests have been held at the Springfield Armory from time to time.

At the present time three (3) models of the semi-automatic shoulder rifle are under development and test; one designed by Brigadier General John T. Thompson, U. S. A., retired, formerly an officer of the Ordnance Department and now a Brigadier General in the Ordnance Reserve Corps; another designed by Mr. John C. Garand, an employee of the Springfield Armory; the third being designed and developed by Mr. J. D. Pedersen, formerly an engineer in the employ of the Remington Arms Company, now of the Springfield Armory.

It is expected at an early date that there will be available for service tests by the Infantry Board and the Cavalry Board 24 of the Garand semi-automatic rifles and 20 of the Thompson semi-automatic rifles.

H. W. SCHULL,
Col., Ordnance Dept., Commanding.

U. S. Rifle, Caliber .22, Model 1922 M1

THE SPRINGFIELD Armory is now engaged in the manufacture of 8,300 of the new caliber .22 rifles, orders for which were received during the past few months. This rifle is known as The U. S. Rifle, Caliber .22, Model 1922, M1.

Thirty-three hundred of these rifles are for issue to the Regular Army, 4,000 for issue to the Reserve Officers Training Corps at the colleges and universities, and 1,000 are for sale to members of the National Rifle Association

through the Director of Civilian Marksmanship. It is expected that before long additional orders to cover the needs of the National Guard will be given.

This caliber .22 rifle, which, up to a range of 200 yards, is practically as accurate as the service rifle, represents an important peace-time development for training purposes and for the purpose of stimulating and keeping alive an interest in marksmanship, especially in localities where on account of its great range and power, it is impracticable for individuals and organizations to have training in marksmanship with the service rifle.

The weight of the new caliber .22 rifle is approximately the same as that of the service rifle and the bolt mechanism, which is that part of the weapon which locks the cartridge in the barrel, is the same as that of the service rifle.

The new rifle is a magazine loader, there being a small magazine holding five rounds, which is inserted from the underside of the weapon just forward of the trigger guard. This magazine, when in place, is flush with the stock.

The rear sight is considerably improved over that of the service rifle and is set quite close to the eye so that the marksman can aim with greater ease and certainty. This sight combines the latest views regarding this feature of small arms construction.

The stock, approved by the Infantry and Cavalry Boards, has a well placed pistol grip giving to the trigger hand a more secure grip and better control over the discharge of the weapon while the butt of the stock is of such a length and drop that it fits admirably the average rifleman in the standing, kneeling, sitting and prone positions.

The same standards of excellence will be maintained in the manufacture of the caliber .22 rifles at the Springfield Armory as have obtained in the production of the caliber .30 rifles for the National Matches.

H. W. SCHULL,
Col., Ordnance Dept., Commanding.

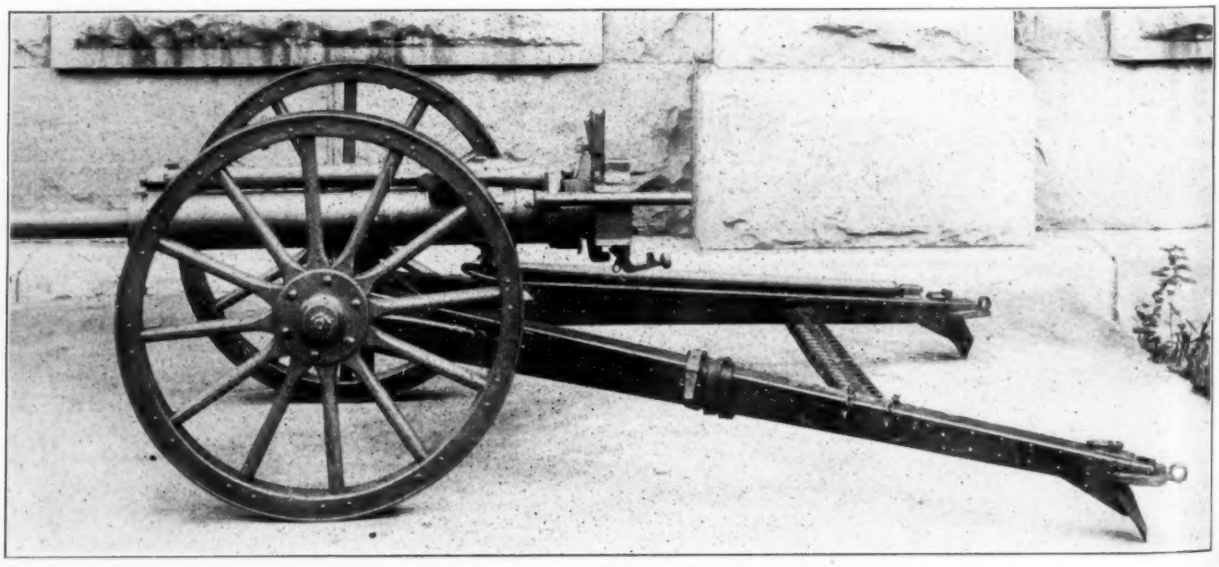
WATERVLIET ARSENAL

37-mm. Gun, Model 1925 E

THE 37-MM. GUN, Model 1925 E, is designed primarily as an improved Infantry accompanying gun. This design does not meet all the requirements laid down by the Caliber Board for an ideal accompanying gun; but it was considered advisable to produce this design at this time. The Caliber Board calls for a larger gun than the 37-mm. It points out that a heavier projectile is required due to the recent developments in armored tanks, machine gun nests, etc.

The 37-mm. 1916 Infantry accompanying gun is a low velocity gun and is capable of penetrating armor of a limited thickness. The 37-mm. Gun, Model 1925 E is a gun of almost twice the muzzle velocity and consequently has a much greater penetrating power. It is light, easily assembled and disassembled in the field. It is mounted on two wheels which are easily removed. By using this gun with wheels mounted it makes it very easy for the Infantry to draw it into position, or if desirable, to attach several of these guns to a self-propelled vehicle and make considerable progress on the road. When in position these wheels can be removed and the gun and mount can be set up very close to the ground in minimum time. The trail is of the so-called "split trail" type, made of a pressed steel structure which reduces the weight considerably.

The gun itself is very simple. The cradle and recuperator are a unit assembly, and when the gun tube (or barrel) is slipped into place in the cradle, the detachable breech ring is held in position and by rotating the tube it is locked by means of interrupted threads to the breech ring. These two members are then held in position by locking devices at both the top and bottom of the breech ring. The counter-recoil spring and recuperator are then secured and the gun is ready for operation. The breech ring is a unit assembly containing the breech block and firing mechanism. The breech block is of the drop block type and the firing mechanism is the simple pin and spring type with a lanyard or hand-operated hammer. The gun is of the single shot type, that is, each round is loaded by hand and the block is closed by lever action. When the gun has recoiled and counter-recoiled into the battery, by the same lever action the block is opened and ejects the empty case, leaving the gun in the open position ready to receive the next round. With a fairly well trained gun crew, it is anticipated that a minimum of twenty rounds a minute can be fired. The present ammunition is designed to give a muzzle velocity of 2,000 feet per second with a projectile weighing a pound and a quarter. It is presumed that this gun



Wooden Model of the New 37-mm. Gun and Carriage, M. 1925 E

will find use for the three types of 37-mm. ammunition now in existence, namely: the armor-piercing, the supersensitive fuze and the solid shot.

When it is necessary to do so, this complete unit, gun and mount, can be broken up into several individual manpower loads. The maximum weight of any of these loads is 50 pounds. This feature enables the Infantry to carry the gun wherever its mission directs.

The accompanying illustration is of a wooden model of this gun, but it shows the gun in detail as manufactured at Watervliet Arsenal. The carriage and recuperator were manufactured at Rock Island, where also was made the wooden model shown in the illustration. This photograph shows the combined latch and lever at the top of the breech ring which opens and closes the breech block. The hammer is retained in the lower part of the breech block and is rotated by a lanyard about a fixed pivot. The dropping of the breech block operates two extractors which throws the case far enough to the rear to be clear of the gun operators. It will be noticed in the picture that the gun is provided with a panoramic sight which is attached by a bracket on the left side of the gun. The rod shown on the left side of the gun has two purposes, it aids in the assembly of the breech ring to the breech block and also primarily prevents the gun sighter from coming in contact with any of the recoiling parts.

The general construction of the gun is very rugged and is well adapted for field use and the Ordnance Office has every reason to anticipate very favorable results from the preliminary test.

It is believed that this gun will at least equal the antitank gun recently developed by one of the European nations. A recent report on the characteristics of this gun is in substance as follows: "Five patterns of projectiles have been tried and the best of them is highly satisfactory. It has a muzzle velocity of 600 meters per second and has pierced 2-cm. of steel tank armor at a range of 400 meters. The weight of this projectile is somewhat between 700 and 800 grams. The gun is securely carried on mules, but in action the loads are distributed among six men. The heaviest load being carried by one man is 24 kilograms."

A. H. Skinner,
Captain, Ordnance Department.

BRIDGEPORT ORDNANCE DISTRICT

THE Bridgeport District has been concentrating on the preparation of factory war plans by the manufacturing plants having prime contracts. All plants have been studying the question quite thoroughly, and, with the exception of two plants, definite information has been received from all of these companies covering their requirements in machinery, raw material and components to accomplish their emergency production. This information varies in completeness from a mere outline for the less definite articles to a very complete study of some of the more complicated articles.

In most of these cases the factory plans are drawn up to show by operations on each component the machinery required for the operation, the production per machine, the total machine requirements, existing machinery available and the balance to be secured. The same information covering small tool equipment and in a number of cases the same information for working gages has been received.

The District is gratified to note that this information represents in every case an intelligent study of the situation for each plant concerned and is a definite statement of probable requirements which will be of value for an emergency.

A meeting of the Bridgeport District Organization was held on March 28th with a large attendance. At this meeting it was decided to go into the mobilization plans of the district very thoroughly during the coming year, each officer concerned preparing his own portion of the plan covering his probable duties from the day of his call to active service and thereafter during the first year of mobilization. It is proposed to study these individual plans with the officer concerned and by this means arrive at a more definite state of preparedness of the district and also use this procedure as a means of training for individual officers in their respective duties.

The meeting was followed by a dinner which was ably arranged by two of the Reserve Officers. The dinner was followed by an illustrated lecture on recent developments in Small Arms and Small Arms Ammunition by Major Glenn P. Wilhelm, Chief of the Small Arms Division in the Office of the Chief of Ordnance.

It is the sad duty of the District Chief to report the death of Major Edwin F. Moody, Ord. Res., who had been assigned to the Bridgeport District for the past two years as Assistant Procurement Officer for the District. Major Moody died at his home, in Springfield, Mass., on March 29th, after a month's illness from influenza. He has been identified with the tool steel, machinery and factory equipment trade and at the time of his death was connected with the National Equipment Co. as their western representative. During the World War he served as a Captain in the Ordnance Department from June 25, 1917, until March 26, 1919, as a buyer of shrapnel and shell for the War Department and later as supervisor of the conversion of industrial plants for ammunition production. He was promoted to Major on April 7, 1924. Major Moody was born in New York City, January 17th, 1869. At the age of twelve his family moved to Northfield, Vt. He is survived by his wife and two sons, Edwin D. Moody, of Northfield, and Lawrence, of Willimansett, and one daughter, Elizabeth.

During his connection with the Ordnance Reserve, Major Moody manifested great interest in military affairs and was a frequent visitor to the District Office and to the Office of the Chicago District when his commercial business required him to be in the West. His loss will be keenly felt by this organization and by all those who knew him.

D. G. McGregor,
1st Lieut., Ord. Dept., U. S. A., Executive Assistant, Bridgeport Ordnance District.

Letters to the Editor

A Reply to Major Wilhelm

(*See* ARMY ORDNANCE, *Nov.-Dec., 1924, page 613*)

Editor, ARMY ORDNANCE:

Major Wilhelm objects to the proposition that in testing the bore of a gun barrel to determine if it has been eroded sufficiently to make it unserviceable, or in testing a new type of projectile to determine if it is better than an old type, the firing should be conducted at the longest range practicable. He says that the proposition *may* be true for large caliber weapons, but that it is surely untrue for small arms because experience has proved it so. In attempting to improve an accuracy test already considered unsatisfactory, a shortening of the range and a consequent introduction of additional troubles was proposed. If a range of length suitable for satisfactory accuracy tests is not available at any post, then the gun barrels should not be tested there, but should be collected and sent to a post having more suitable facilities, as is sometimes done now.

Any ammunition expended in a short range rifle accuracy test, especially if it is not a comparative one, is wasted. Instead of firing 30 rounds at short range from the worn rifle, ten rounds from a new rifle and ten rounds from the worn one fired by the same man (to eliminate personal error) using a muzzle rest, one group followed immediately by the other at a range not less than 1,000 yards, would give a much better test. That is, it takes many rounds at short range to determine what a few rounds at long range can determine. Although it increases the amount of ammunition expended, firing a new gun at the same time eliminates the question of weather variations and gives a definite answer to the question. It is absolutely necessary to make the test competitive by firing a new gun at the same time, unless the old one is so worn that the projectiles tumble.

Consideration should be given to having National and International Match ammunition firings made at extreme ranges in addition to those at short ranges. This can be done easily at the Proving Ground.

In the prescribed machine gun accuracy test at 1,000 inches it is recognized that the test shows only when the bullet yaws or tumbles badly and therefore no comparative measurement of dispersion, such as Major Wilhelm advocates, is made. When the bore is in such a condition that key-holing is resulting, it was long since worn out and should be discarded immediately. A gun which develops only a few key-holes at 1,000 inches will show a tremendous dispersion if fired at extremely long ranges. In a long range machine gun accuracy test a single burst from a worn barrel followed by a burst from a new barrel placed on the same gun and mount would give definite results without further waste of ammunition. Machine gun accuracy firings at the Proving Ground should certainly be made at extreme ranges.

If a floating barrel, muzzle packing, gland, or headspace, increases dispersion, the amount of increase for a particular range will be about the same regardless of whether or not the bore is eroded. It is the interior of the barrel which is tested for erosion and not the exterior. A gun barrel made unserviceable by erosion can ordinarily be made the equivalent of the new one by relining. (Salvaging Rifle and Machine Gun Barrels, by C. F. Armstrong. July-Aug., 1921, ARMY ORDNANCE, page 47.)

Before the World War small arms firing tables were based on range firings made up to 1,000 yards; tabulated values for longer ranges were based on these short range firings. As a result, the prewar tables gave a computed maximum range for the 150-grain bullet Model 1906 as more than 5,000 yards, whereas post-war *firings* have shown the maximum range to be about 3,450 yards. (Long Range Small Arms Firing, by G. P. Wilhelm, Jan.-March, 1921, ARMY ORDNANCE, page 209). This illustrates:

(1) The difficulty in determining a satisfactory average value of the ballistic coefficient of a projectile at short ranges, and

(2) The fact that for small elevations, the shape of the projectile is of minor importance, the important quantities being the same as those *in vacuo*, namely, elevation and muzzle velocity. If a ballistic coefficient based on long range firing had been computed it would have been satisfactory also for ranges below 1,000 yards. In artillery firing these principles are being recognized, but in small arms firing they have not yet been acknowledged as true.

PHILIP SCHWARTZ,
Lieutenant, Ordnance Department.

Gravity Method of Shot Manufacture and Shot Towers Still in Use

January 22, 1925.

Editor, ARMY ORDNANCE:

In your November-December, 1924, issue there appears an article on pages 603-604 entitled "America's Oldest Munitions Plant." Among other statements therein appearing is one to the effect that " Phoenix Tower, known also as the Merchants' Shot Tower, is the only shaft of its kind standing virtually intact in the United States, and, so far as Miss Marine has been able to ascertain, in the world."

Questioning this statement, I wrote to the Western Cartridge Company of East Alton, Ill., under date of January 6, 1925, and they replied to the effect that they are " manufacturing shot by the gravity method in shot towers and do not know of any other shot manufacturers in the United States that are not using the gravity process."

This being the case, it would appear that the Phoenix Tower is by no means the last of its line and that the shot tower as a factor in shot manufacture is a long way from becoming obsolete.

Yours very truly,

CALVIN H. GODDARD,
Major, Ordnance Reserve.

Book Reviews

History of the American Frontier. By Frederick L. Paxson. Boston: Houghton Mifflin Company. 598 pages. 1924. $6.00.

A HISTORY without a tedious succession of maps showing the disposition of hostile forces and the development of campaigns, is indeed balm to the tired military and naval reader. In his "History of the American Frontier," Frederick L. Paxson, instead of describing successive waves of attacking lines, moves off so as to keep the whole expanse of the country ever in his perspective, and describes the growth of the thirteen colonies into a nation of forty-eight states. Wars, campaigns, battles and even some skirmishes are mentioned in their appropriate places, for the conflicts of a virile nation have a profound effect on the progress of a people. But their purely military aspects are suppressed in favor of their immediate political and social effects as, of course, they should be when the study is essentially of a people, the geography of their expansion and the relation between their intellectual "movements" and their political development.

The period considered is that beginning in 1763 and ending in 1893, and a right stirring time it was. It began with the eager settlers stealing surreptitiously beyond the line along the Appalachian Mountains designated by the cautious Mother Country as the limit for white settlement and continued through the era of the victorious Continental leaders, who soon gave way to Jefferson's adherents. These were replaced by followers of Jackson who held sway until Lincoln lead the newest party to victory and office.

This period witnessed the fluctuating rise in prosperity of a rapidly growing country, punctuated by four great financial panics. These had the effect of swelling tides of migration westward, where the new communities crystalized the latest panaceas and ideas of government into state constitutions. The era of public roads overlapped the period of canal building, which was overshadowed in turn by the rapidly advancing railroad age. And through it all runs the story of the golden eggs—public lands—for which thousands left security and comparative comfort to stretch forth their hands for their rewards. Dramatic interest is furnished by the sadly harassed and sometimes vengeful Indian, while diversions occur in the press for the Santa Fé trade, the California gold rush, and the short-lived ascendancy of the cowboy. But as long as they lasted, public lands were at the bottom of many of the popular and governmental manifestations of the times.

One receives the impression that the smart agents sent to perform the ceremony of accepting lands from the Indians from 1812 to the Minnesota massacre in 1862 were rather successful in preventing counterblasts from the consistant losers in the trade, yet the War Department records indicate no less than thirty-two Indian campaigns during that time.

In a comprehensive study of the character under review, very general statements must serve. For instance, the author states that Braddock in 1755 moved up the Potomac from Alexandria, Virginia, to Fort Cumberland. But it seems established that Braddock crossed the Potomac near Georgetown and, as readers of Franklin's autobiography will remember, the General went first to Frederick, Maryland, where he attempted to round up horses and wagons. Failing in this, he moved to Will's Creek (Fort Cumberland) where Franklin's efforts supplied him with the necessary transportation facilities.

There appears to us to be only one important error of omission in this volume. A history of our frontier is not complete unless it includes a record of the fact that at one time Lower California was proclaimed an unalterable part of the United States. On the strength of these assurances, many of the inhabitants took up arms against their Mexican rulers in 1846. The desperate defense of San José (on the tip of the peninsula) by Lieut. Heywood, U. S. N., with forty-five marines and civilians against about two hundred Mexicans was prevented from being another Alamo only by the irresolution of the enemy and the timely arrival of two American whalers. These doughty merchantmen contributed their sounding leads for shot and kept off further attacks by their determination to assist as long as danger threatened. Their departure, however, was a signal for a second siege by cavalry three hundred strong, which was relieved just in the nick of time by a man-of-war. Finally New York volunteers cleared the peninsula of the enemy and held undisputed sway. Yet the peace negotiators seem to have ignored this territory and our nominal frontier receded to the northern line in force today. The inhabitants who espoused our cause were left to the mercy of their former lords, while the pearl fisheries, naval bases, minerals and oil that this region affords are still awaiting the enterprise necessary to develop them.

We must admit that the author's thumb nail reviews of the authorities cited, as the work progresses, has converted us from the position that an appended bibliography was almost indispensable in studies of this character. Taken in conjunction with the thorough index, they afford more relevant information as to sources available than does the standard method. The author modestly avers in his preface that his successors "will of course do better." Possibly so, but he has nevertheless set a high standard of performance which nothing but the highest scholarship can hope to excel.

Woodrow Wilson. By William Allen White. Boston and New York: Houghton Mifflin Company. 1924. $5.00.

SINCE the passing of Woodrow Wilson there has been a general agreement on at least two phases of his spectacular career. The one: that his ultimate place in history cannot be determined with the meager perspective of today; his own generation being influenced by the

petty quarrels and personalities that surrounded him cannot view the man independently of them. The second, and perhaps a less serious condition, is the inability of any biographer who has yet attempted the task to prevent his work from being savored with his own dominant viewpoint either of praise or unfavorable criticism.

William Allen White, the sage of Emporia, has probably approached the goal of ideal biography of this great character in a more objective way than any who has thus far attempted the task. His viewpoint, his sympathetic attitude, and his fair judgment combine to make his work easily the most outstanding biography of Woodrow Wilson. There is less of petty jealousy shown in his work than in those who have written of Mr. Wilson and who have been unable to disguise their deep-seated criticism of all that he did. There is more of a fair appraisal and a sincere agreement on purely abstract principles than in the books written by his greatest admirers and intimate friends. Strange to say, as Mr. White relates, he knew the great war president very slightly and had no intimate knowledge of him other than he gathered in the compilation of facts for this book.

The major facts and accomplishments of Woodrow Wilson are, of course, well known to friend and foe alike. In this respect Mr. White's biography is merely a duplication of data that has appeared over and over again. This of necessity must be true of any man who is written about by many authors. Therefore, whatever distinction this book may have lies entirely in its method of treatment and in point of approach, and in this respect Mr. White performed a great work in an admirable fashion. He has interviewed and corresponded with a great many people who knew the war president during the early years of his life, during the days of his presidency at Princeton, as Governor of New Jersey, as President of the United States, and in his retirement in Washington. If there is any fault whatever to be found with the book, it lies in a preconceived attempt to be sympathetic. While most will admit that Mr. Wilson's career seems to have been imprinted with the hand of destiny, whether or not the thread can be traced back to the early days of his life, and have made him stand out as a prophetic figure even among his youthful companions, is slightly far-fetched. "Tommy" Wilson was undoubtedly a boy of unusual characteristics, while Woodrow Wilson was a man of strong determination which may or may not have been an outgrowth of his boyhood habits and influences. Be that as it may, no one who reads Mr. White's book can overemphasize this feature of it because any faults that may exist in it are far overshadowed by his great work. It is a real biography that should live as long as the memory of the man he writes about exists. It is one of the best, if not the best, of the biographies of Woodrow Wilson yet written.

The Contrast. By Hilaire Belloc. New York: Robert M. McBride & Company. 1924. $2.50.

MR. HILAIRE BELLOC, the great English essayist, found, in his recent visit to these shores, not only a great topic about which to write a book, but a great contrast between the new land and the old which he has written down in a pleasing and interesting fashion. Of course anything Mr. Belloc writes is always interesting whether one agrees with his viewpoint or not. It is hard to see how any American can be overenthusiastic about his thesis while everyone must admire his style.

One is prompted to recall the words of Scott—

> "Lives there a man with soul so dead
> Who never to himself has said,
> This is my own, my native land."

Like all good Englishmen, Mr. Belloc knows the true import of such words and it is hard to see how he can interpret them in any other way than he has done in his book. He finds in America a great contrast as compared with his own land, not only in its physical makeup but in its people, its customs, its institutions, and even in its outlook on life. Some of these he finds to be entirely creditable to America while others do not compare in such a favorable light. Likewise with some of his observations even Americans must agree, particularly as to the physical makeup of many of our communities such as Mr. Belloc visited on his recent tour.

For literary style the book is a gem. For its unique purpose it is quite unusual. It makes good reading when other less critical books are not at hand, but its viewpoint is in some respects so stated as to mar its ultimate value. Mr. Belloc has written other books that show his mastery in a much better way, and a rereading of one of his old efforts might be more interesting than this new one.

A. S. T. M. Standards—1924. Issued triennially by the American Society for Testing Materials, 1315 Spruce Street, Philadelphia, Pa. 1230 pages. $12.50 for nonmembers.

THIS volume covers standard nomenclature, standard methods of making tests, together with standard specifications for various raw materials as well as numerous finished products. The work is not limited to any particular class of materials but includes metals, both ferrous and non-ferrous, non-metalic substances such as building materials, textiles, road materials, refractories, etc. The complete set of standards is published triennially, the last previous publication having been in 1921. There is, however, published annually an addendum covering standards adopted during the year. There is also published annually a set of tentative standards. These tentative standards may be published for several years, criticism being invited, the final adoption as a standard occurring after substantial agreement has been reached. The present volume contains 220 standards. There are also at present approximately 185 tentative standards. The previous volume in 1921 contained about 900 pages, the increase from 900 to 1230 being something of an index of the activity during the three-year period.

The Society is cooperating with various other bodies such as the American Engineering Standards Committee, the Engineering Division of the National Research Council, the American Bureau of Welding, the Joint Committee on Investigation of Phosphorus and Sulphur in Steel, the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, the Joint Committee on Concrete Culvert Pipe, the Conference Committee with A. S. M. E. Boiler Code Committee, and the Joint Committee on Standard Pattern Practice. In addition, there is cooperation with various Government agencies such as the Bureau of Chemistry, Bureau of Mines, Bureau of Public Roads, Bureau of Standards, Forest Products Laboratory, and the Watertown Arsenal Testing Laboratory. The standards arrived at in co-

operation with these various agencies should have a broad field of usefulness. These standards are being freely used in the preparation of War Department specifications as well as in the preparation of the Federal Specifications. These Government specifications, while not always in exact accordance with the A. S. T. M. specifications, are fairly well in harmony therewith.

The triennial publication of the A. S. T. M. standards is so well known to engnieers generally that a detailed review of the contents seems unnecessary. The present size of the 1924 edition (1230 pages, together with 185 tentative standards pending), indicates that the time is not for distant when it will be necesary to publish this work in several volumes. It is assumed that consideration is already being given this subject. When the time comes for the separation, it would seem that the several volumes should be complete in themselves, completely covering certain types of material such as divisions between matallic and non-metallic and further sub-divisions such as building materials, fabrics, lubricants, paints and preservatives, etc. In this way, engineers interested in only one particular branch could secure a volume bearing on the particular class of material in which they are interested.

The A. S. T. M. is doing valuable work in the preparation and publication of standards. It is possible that for the time being there may be no great disadvantage in having standardization work carried out more or less separately by various engineering bodies since the subject is sufficiently large to give plenty of work for all. However, there should ultimately be some coordinating agency to establish standards which will be known as national standards and which will be generally recognized and followed.

The Monroe Doctrine. By Alejandro Alvarez. New York: The Oxford University Press. 1924.

WRITING in *The American Mercury* for February, 1925, Mr. Charles C. Thach has this to say as to the average understanding of the meaning and importance of the Monroe Doctrine:

> "The Monroe Doctrine ranks among the foremost of the fetishes of these fetish-worshipping United States. Senators, by their own admission, are ready to shed their life blood for its defence. Representatives, though not of the elect whose privilege it is to serve the shrine of Foreign Policy, make Fourth of July orations upon it. American Legion posts and Chambers of Commerce take it under their protection lest it be assailed by the slimy touch of the abominable Red. Presidents and candidates for President stand upon it as upon the rock of their salvation. And, from the grades to the graduate schools, searchers after knowledge listen with bated breath to its exposition by school marms and *Doctores Philosophiae*. Yet probably not one of these passionate partisans, whether pedagogue or politician, Rotarian or legionnaire, could tell you, on penalty of hanging, what the Monroe Doctrine really is."

If Mr. Thach's diagnosis is to be taken as accurate, the need of such a book as Mr. Alvarez has compiled is indeed greater than at first glance may appear. Everyone is, no doubt, familiar in general terms with the meaning and scope of the great doctrine which takes its name from President Monroe. Many, it may be, are familiar with the various interpretations which from time to time have been placed upon it. It is hard to conceive of anyone versed in historical traditions who is ignorant of at least the major applications to which this important American doctrine has been put. But to assemble in one place not only the principal American commentaries upon it but Pan-American opinion as well, is indeed a contribution to the literature on the subject which should be far-reaching.

In this volume Mr. Alvarez, with the cooperation of the Carnegie Endowment for International Peace, has gathered together the principal expressions of opinion of the leading Central and South American statesmen of the past century and has quoted them both from the standpoint of their importance and their chronological order. In addition there is a very valuable historical essay upon the subject by the author himself, and the volume closes with the principal declarations of our own American statesmen, notably, Messrs. Roosevelt, Root, Taft and Wilson, in their various addresses and state papers on the subject.

Certain it is that even an offhand perusal of this book will shed light on many points of interest which are to the average reader still hazy tradition. The American idea is usually that based upon school room facts and possibly political campaign interpretation. Here is an authentic collection of opinions, historical and otherwise, on the famouse Monroe doctrine which in these days is on the tongue of even the casual reader.

The valuable work which the Carnegie Endownment for International Peace is doing in bringing out such volumes as this is beyond reckoning. Likewise the excellent service of the author in his painstaking compilation as well as his clear and definite pronouncements is deserving of the thanks and gratitude of all those who hold this dogma of American development in the high place which it deserves. The book is more than a text book, it is indeed a very concise history which will, we feel, grow in importance and value as time goes on.

Law and Morals. By Roscoe Pound. Chapel Hill: The University of North Carolina Press. 1924. $1.50.

IN this volume are published the John Calvin McNair lectures given by Dean Pound at the University of North Carolina during the scholastic year 1923. In them are given a clear position of the interrelationship between morality and law with particular relation to the predominating aspects of the moral code.

Such a topic is one that well befits the eminent Dean of the Harvard Law School, whose breadth of vision, great learning, and renowned ability to set down age old tenets, is well known. His lectures both at Harvard and before bar associations throughout the country, have rightly marked him as one of the greatest legal lights of today.

It is therefore especially significant that Dean Pound should discuss the broad and fundamental topics connected with the subject of this book. He treats first principles upon which all law is founded but which, through time and circumstance, have been warped into forms and shapes quite contrary to the original purpose. His theme is that law and morality, being parallel, should remain so throughout any change of conditions. The historic background with which he clothes the treatise as well as the modern applications of his theories are not only interesting but decidedly true and necessary.

Such a work as this of Dean Pound should have an universal influence especially in this day when law aims to be the ruling force of men. After all, the impelling motive actuating those who favor such instrumentalities

as the World Court is the preeminence of law, and law without morality is worse than no law at all.

We highly recommend Dean Pound's masterly work for interesting reading and careful study.

Safety Manual for Operating Plants Using Hazardous Materials Operated by or for Ordnance Department, U. S. Army. Published by the Army Ordnance Department. Washington: U. S. Government Printing Office. 1924.

THOSE in authority in the Ordnance Department have felt for a long time the dire need of an up-to-date manual for use in government and commercial plants engaged in hazardous operations. There have been issued from time to time numerous small pamphlets descriptive of good practice and regulatory measures for safety in munitions plants. These have accumulated with no general coordination and little reference value because of their increasing numbers. The Department has therefore published this manual in which are gathered in one place regulations for safe operation of explosives and chemical plants with particular reference to manufacturing facilities as distinguished from storage. It is understood that future volumes will relate to the storage feature.

The book is divided into three main subdivisions: section 1, safety rules and regulations; section 2, safety standards; section 3, instructions for handling. Under the latter subject detailed regulations for the various chemicals and explosives are set out in detail. Needless to say under the subjects covered in section 1 are included the more general recommendations relating to good practice both as to organization, personnel, and administration.

Here is a little volume primarily intended for government plants and those engaged on government contracts that might well find broad application in commercial life. Those who are faced with problems relative to the storage and handling of chemicals, hazardous and otherwise, would do well to examine this book and apply the suggested procedure in their own industrial fields. The book is written in an interesting way and is a credit to the Department.

The Elements of Machine Design. By S. J. Berard and E. O. Waters, New York: D. Van Nostrand Company, 1924. 323 pages.

THE authors are professors of machine design and have prepared this book to meet the particular needs of students in technical schools.

This work covers the subject in very much the conventional manner, starting with general considerations governing good practice in drafting and machine design. This is followed by a chapter on simple mechanics and strength of materials. The usual chapters on Fastenings, Shaftings, Bearings, Gearing, Cams, Linkages, etc., then follow. Drawings for the illustrations are well prepared and harmonize with half-tone cuts showing the actual product of representative manufacturers for each class of material.

The book appears to be entirely up to date and incorporates the latest standard practice on the various elements of design, including working stresses.

The final chapter covers the various features of drafting room systems such as location, lighting, ventilation, etc., of the drafting room, its functions, organization, etc. Standard practice on preparation of drawings, filing, standard lists of parts, data books, etc., are also included in this chapter. Finally, the question of equipment, including drafting tables, drafting machines, blue print machines and photostat machines is briefly described and modern types illustrated.

Again, this book is primarily for the use of the student, for which purpose it appears to be well adapted. It should, however, also be a valuable addition to any drafting room reference library, not only for the subject matter contained in its text but also for the numerous references to other publications which are given at the end of each chapter.

National Guard Training Schedules. By Davis P. Livingston, Iowa National Guard. Washington, D. C.: Quartermaster Association. 1924. 50 cents.

CAPTAIN DAVIS P. LIVINGSTON, of the Iowa National Guard, a graduate of the Infantry School, class of 1924, has prepared this series of National Guard Training Schedules embracing the following subjects: (a) Rifle Companies, (b) Machine Gun Companies, (c) Battalion, Regimental, and Brigade Headquarters Companies. Each is issued as a separate pamphlet, the series being compiled in four uniformly bound brochures.

The general advantages to be gained from a study of these training schedules are apparent in that a standardized training is set out in a clear, readable, and concise way. The schedules are replete with suggestions for non-commissioned officers' schools, and should save a large amount of time usually spent by company commanders in making schedules for the study of regulations.

The issuance of this series of pamphlets by the Quartermaster Association is of real service to the Army and should be encouraged by all who have occasion to use data of this kind.

The Founders of America. By Edwin Wildman. Boston: L. C. Page & Co. 1924. $2.00.

IT IS AN encouraging sign when authors of ability turn to the publication of stories that will interest young and old alike on the fascinating topics of our early American history. While our text books are complete in every detail as to the lives and accomplishments of the founders of the Nation, few of them are written in the non-technical and vivid way in which Mr. Wildman has presented the stories of those whom he terms "Founders of America."

Here are brought together a very authentic collection of biographies concerning many of the men who are responsible for the master stroke of founding a great republic. Mr. Wildman writes of them in a way that is both pleasing and accurate. If any fault is to be found with him at all it would be that he has neglected to include in his category the names of some men who who are equally entitled to fame. It can be well seen, however, that the limitations of such a book as this preclude comprehensive treatment of all who are worthy of mention.

Of course the better known of the organizers of those days are treated, while some who, to the lay mind, may not be so familiarly known are also described. All of them are represented in what history is pleased to term their true light, and the book, while primarily intended for youth, should have an ever increasing historical value.

American State Government. By John Mabry Mathews. New York: D. Appleton and Company, 1924. $3.75.

MR. JOHN MABRY MATHEWS, Professor of Political Science in the University of Illinois, and author of "Principles of American State Administration," "The Conduct of American Foreign Relations," and other equally important and well-known theses on the science of government, presents in this volume a very clear and complete treatise on the peculiar system of American state government.

Unique in theory and dependable in practice, the American system is today acknowledged as the crowning effort in political science. A system of states, each locally self-governed and all united under a federal authority, the American plan has withstood, during nearly a century and a half, the trials and tribulations which other forms of government have not been able to overcome. The qualities and peculiarities of this form Dr. Mathews describes in a most exhaustive way. He discusses not only the activities peculiar to the states, but those which are conceded the federal authority and even those which are inherent in municipalities and other smaller subdivisions.

To the student of political science his book is of untold reference value in that it has gathered into a single volume facts and theories which heretofore were spread out among a great many reference books. The work is primarily a text book, but should have an ever-increasing value among all students of political science. The name of Dr. Mathews is itself sufficient warranty that the work is well done.

In this volume there is in addition a broad conception of the American state theory which is not to be found in other books of this kind. We predict for it a wide popularity and an ever-growing following.

Today there seems to be an ever-rising tendency particularly on the part of the intelligista of the press to raise a great hew and cry against certain of our time-tried state customs. Forgetful of the great precept that ours is a government of law, not men, they would cast aside procedure and national habit in favor of a more modern, or shall we say a twentieth century, interpretation of statehood. But there is a fundamental urge in human nature that spruns a radical change until there is no other alternative. And this factor the Founding Fathers understood only too well.

Those of us who at times are vexed at the trying slowness of our legislators and executive officers—state and national—would do well to digest Dr. Mathews' monumental work.

International Law. By Charles G. Fenwick. New York: The Century Company. 1924. $4.00.

APROPOS of the popular tendency among men and institutions for restatements of principles and laws which through the passage of time have accumulated into voluminous texts, this book of Charles G. Fenwick, Professor of Political Science at Bryn Mawr College, comes as an opportune and welcome treatise on the subject of international law. No less an influential organization than the American Bar Association itself has strongly advocated a restatement of our own national codes, while other organizations in various theaters of activity have also patronized similar codifications. Thus the work of Professor Fenwick, which is really a restatement of the tenets of international law brought down to date, has admirably taken care of this phase of law in its restatement aspect. International law itself, which was purged of all unnecessary doctrines by the conditions of the World War, needed such treatment in order that its modern applications might be thoroughly stated and understood. Of course the time-tried historical doctrines which are the fundamentals of international law, needed little elaboration, hence a historical treatment of them with their various modes of development and their pet applications in history is all that can be done with regard to them. This portion of Professor Fenwick's book is very enlightening and makes entertaining reading.

The more modern developments which he treats in the same broad and characteristic way have a double significance in that they have brought down to date the more modern phases of internatoinal law as well as that they show the myriad ramifications which the demands of modern war have placed even upon international law itself. His treatment of neutral rights and obligations as well as aerial warfare and declaration of war are quite the latest pronouncements on the subject. Very fine distinctions have been drawn as to the several subdivisions under the various headings, and these likewise are both authentic and concise.

It is very obvious that the author has endeavored to avoid unnecessarily technical language and to present the data in a form which is readily understandable. The analogy between international and national law which can be identified throughout the work is a very valuable guide to the student as well as the casual reader in that the developments of one can be logically traced against the applications of the other.

For Professor Fenwick's book we can say that it is certainly a most welcome contribution to the many volumes already existing on this important subject and its appearance at this time has added significance in that it is a thoroughly reliable text.

Structural Metallography. By H. B. Pulsifer. Easton: The Chemical Publishing Co. 1924. $5.00.

THIS text, according to the author, was written primarily for beginners in metallography. It is a synopsis of the work of many investigators and includes a long bibliography of some of the publications of the best authorities. It is a book of some two hundred pages, written in good English, printed on good paper with clear type. It is profusely illustrated with many well reproduced photomicrographs taken at various magnifications, and the author is to be commended for specifying the etching reagents used to reveal the structures so clearly shown in the illustrations. Their omission is a fault very common in many other publications.

It would seem, however, that the author frequently assumes that the reader has a fair working knowledge of metallography, as he uses freely many of the usual metallographic structural terms without explanation until the latter half of the text. When they are defined, the definitions and explanations of some of the terms are rather too involved for the beginner. His many references to the recent theories without adequent explanations are somewhat confusing. The author is rather prone to wander from the subject which he has captioned in the various chapters, and has added material which has no direct bearing on the subject under discussion.

Taken as a whole, the text is hardly elementary enough for students beginning metallography. The author has attempted to cover too wide a field warranted by the size of the book, with the result that many of the basic principles have been omitted or skimmed over.

Recent Patents

Brief Descriptions of Inventions of Interest to Ordnance Engineers

Compiled by W. N. Roach, Chief, Patent Section, Office of the Chief of Ordnance

SOME recent patents relating to Ammunition are the following:

Patent No. 1,520,131 for an oblong drop projectile, was issued to H. Jacob, assignor to the firm of Optische Anstalt C. P. Goerz Atkiengesellschaft. This patent was issued under the Act of March 3, 1921, known as the Nolan Act. The patent covers a drop bomb having a strong walled explosive chamber and a hollow cone-shaped tail of sheet metal, the whole forming a lancet body having a smooth outer service and a pointed rear end.

Leslie B. Taylor has been granted patent No. 1,521,406 for a projectile, the main object of which is to properly place the center of inertia with relation to the length of the axis and radius of gyration of the body so as to prevent exaggerated precessional disturbances.

Arturo Ciano has been granted patent No. 1,521,996 for a hand thrown bomb. The main object of this invention is the provision of a fuze having three safety elements, one of which is removed by hand after cocking the striker, the second of which is automatically eliminated during the travel of the bomb and the third one allows the striker to function when the bomb hits an object.

Henry Newton has been granted patent No. 1,524,273 for a trench mortar. This patent was granted under the provisions of the Act of March 3, 1921, and covers a trench mortar having a hemispherical end shaped to fit in a similar socket in a bed plate with guys attached to the bed and attachable to the mortar.

Patent No. 1,519,302 for a projectile was granted to Nevil Greenwell, assignor to Bethlehem Steel Company. The patent covers a shell having a band seat and a reduced portion rearward of the band seat and separated therefrom by a frangible collar or ring and a filler ring in the reduced portion and frangibly connected to the body.

Artillery

PATENT No. 1,502,383, for a method for examining the relative position of sighting lines, has been granted to W. Bauersfeld and O. Mackensen, assignors to Carl Zeiss. This patent was granted under the Act of March 3, 1921. The method is carried out by flashing simultaneously in each telescope an optical signal from which the position of a target viewed by each telescope relative to the sighting mark may be ascertained.

Eugene Schneider, assignor to Schneider & Cie, has been granted patent No. 1,523,662, for a gun carriage and sighting apparatus of field guns for correcting the varying transverse and longitudinal inclinations of the gun carriage. This patent covers a gun mount in which the gun may be swung with relation to the mount about an axis extending longitudinally of the gun and in which provision is also made for swinging the vertical pivot to a vertical position.

Infantry and Aircraft Armament

ROBERT KAUCH and C. L. Paulus, of McCook Field, have been granted patent No. 1,519,458, for a spade grip. The patent covers a grip having a centrally positioned trigger operating element and finger operated means for operating said element, such means being demountable with respect to said element for right or left hand operation.

Henry B. Inglis, of McCook Field, has been granted patent No. 1,519,454 for a gun reel feed unit. The invention covers a holder attached to the gun in which the reel upon which the ammunition belt is wound is removably held and a feed chute guide for leading the ammunition to the feed way of the gun.

Patent No. 1,519,806 for a magazine pistol, has been granted to the Old Colony Trust Company, executor of the estate of Jos. H. Wesson, deceased. The invention covers a magazine pistol of the slidable barrel type in which the barrel retracting mechanism and the firing mechanism are independent of each other. The advantage claimed for this arrangement is that a positive action of each group of elements is secured and the operator has better control of the aiming and firing of the pistol.

Jos. R. Mahlich has been granted patent No. 1,519,865 for a rifle sight. The sight is formed with a leaf spring attachable to the rifle barrel and carrying a peep sight. A lever operated cam is carried by the leaf spring and contacts the barrel through manipulation of which the sight may be easily adjusted while holding the rifle in aiming position.

Patent No. 1,520,298 has been granted to W. Mann for an automatic pistol. The patent covers a safety device by which the cartridge is locked in the magazine chamber and cannot be unlocked until the breech block is manually withdrawn from the barrel to extract a cartridge, if any still remains in the barrel. There is also provision for locking the firing mechanism upon such withdrawal of the breech block.

Patent No. 1,521,676 has been granted to Rudolph V. Frommer, covering an automatic fire arm. This patent covers special construction of the parts of the fire arm, especially an automatic pistol, so that the same parts may be used in making a pistol with a hammer or a hammerless pistol.

Carl G. Swebilius, assignor to the Marlin Fire Arms Corporation, has been granted patent No. 1,521,730 for an automatic fire arm. This patent covers a fire arm of the gas-operated type, in which the high pressure of the gas immediately after the explosion of the cartridge is applied to means for locking the breech mechanism in its closed position, which mechanism is subsequently released upon the decrease of the gas pressure to allow the decreased gas pressure to operate the breech mechanism.

E. L. Fisher has been granted patent No. 1,521,286

for a trigger for fire arms. This patent covers a trigger having on the finger engaging portion a rotary element or roller which takes up, or compensates for, the traverse movement of the finger so that the true aim of the weapon is not effected when the trigger is being depressed.

Patent No. 1,523,067 has been granted to Geo. Hazelton for a machine gun and like fire arm. The patent covers a movable shutter which entirely closes the cocking handle slot when the handle is in uncocked position and which is automatically displaced laterally against the resistance of a spring to permit movement of the cocking handle. The purpose of this shutter is to prevent the entrance of dust or water to the reciprocating mechanism of a machine gun.

George Hazleton has also been granted patent No. 1,524,973 for a bipod. The main object of this invention is to provide a bipod, the legs of which may be readily folded against the gun barrel when not in use and quickly unfolded to gun-supporting position. These objects are accomplished by providing the bent legs so attached to the bipod head that they may be not only swung on a pivot to a position parallel with the gun barrel, but may also be rotated about the longitudinal axis of the legs.

Patent No. 1,524,974 has been granted to George Hazleton for a gas chamber for automatic guns. This patent covers a specific form of a device for drawing off gases from the gun barrel to be used in operating mechanism of the gun.

Patent No. 1,525,065 has been granted to John M. Browning for an automatic fire arm. This patent covers an automatic fire arm more especially for large caliber cartridges. The main novelty claimed for this device lies in the means for holding and feeding the cartridges, the locking frame and co-operating parts, the means for actuating the breech block to close and open the breech and in the simple construction of the gun which permits it to be taken apart and assembled without the use of any tools.

Mr. Browning has also been granted patent No. 1,525,066 for an automatic fire arm which covers an improvement in the device of the patent just cited. The improvement consists in novel means for pushing the cartridges into the chamber and for supporting and guiding them before and during such movement, novel means for extracting the empty shell and for steadying and guiding it during extraction, novel means for locking together the transversely movable breech block and longitudinally movable lock frame, novel means for readily positioning, supporting and guiding a tranverse movable feeder and in other details of construction.

The same well-known inventor has also been granted patent No. 1,525,067 for a cartridge feeding device for automatic fire arms. The invention covers a feed plate or strip adapted to be fed step by step through a transverse fed channel of the gun, which feed strip is so constructed that it may be fed into the gun either end first.

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